

Groundwater Management Zone Application

Source Area 7
Southeast Rockford Groundwater Contamination
Superfund Site

Contract HWA-16303

Prepared for:
Illinois Environmental
Protection Agency

February 2021



Table of Contents

Section 1 Introduction and Purpose	1-1
1.1 Site Description.....	1-1
1.2 Site History.....	1-2
1.3 Investigation History.....	1-3
1.3.1 Remedial Investigations and Feasibility Studies.....	1-3
1.3.2 Predesign Activities and Pilot Testing.....	1-4
1.3.3 Hot Spot Soil Removal Remedial Action	1-6
1.4 Area 7 Remediation System.....	1-6
1.5 Groundwater Sampling Results	1-7
1.6 Document Overview	1-8
Section 2 Groundwater Management Zone Application	2-1
2.1 General Facility Information	2-1
2.2 Release Information.....	2-3
2.3 Groundwater Management Zone Horizontal and Vertical Boundaries	2-7
2.4 Approved Remedial Action	2-7
2.5 Point of Compliance	2-11

List of Figures

- Figure 1. Area Map
- Figure 2. Site Layout
- Figure 3. Groundwater Management Zone Boundary and Monitoring Well Locations
- Figure 4. Groundwater Management Zone Geologic Cross Section

List of Tables

- Table 1. Area 7 Groundwater Sampling Data
- Table 2. Area 7 Monitoring Well Construction Summary
- Table 3. Area 7 Effluent Discharge Limits

Appendices

- Appendix A. As-built Drawings
- Appendix B. Low-Flow Groundwater Sampling Standard Operating Procedure

This page intentionally left blank.

Section 1

Introduction and Purpose

This document provides the information required for establishment of a groundwater management zone (GMZ) for the Source Area 7 (Area 7) portion of the Southeast Rockford Groundwater Contamination (SERGC) Superfund site (Illinois identification number 2010300074, CERCLIS identification number ILD981000417) located in the City of Rockford, Winnebago County, Illinois.

The Source Control Operable Unit (SCOU, or OU3) record of decision (ROD), dated June 11, 2002, includes establishment of a GMZ as a component of the remedy selected for Area 7. This GMZ application has been prepared by CDM Smith, Inc. (CDM Smith) for the Illinois Environmental Protection Agency (Illinois EPA). Operable Unit 1, or Drinking Water Operable Unit, focused on providing residents with a safe supply of drinking water, while OU2, the Groundwater Operable Unit, addresses the sitewide groundwater contamination outside of the source areas.

The GMZ for Area 7 will cover “leachate,” which is defined in the OU3 ROD as shallow, contaminated groundwater located inside each source area that originated from the contaminant source material within the source area. Contaminated groundwater located outside the proposed GMZ is evaluated separately by the City of Rockford under OU2.

The purpose of this document is to provide Illinois EPA the information necessary to obtain approval for establishing a three-dimensional region containing contaminated groundwater that is managed to mitigate impairment caused by a release of contaminants from Area 7 in accordance with Title 35 of the Illinois Administrative Code Part 620.250 (35 IAC 620.250). The remedy at Area 7 includes multiphase extraction and hydraulic containment.

For a GMZ to be established, the groundwater within the proposed GMZ must be managed to mitigate impairment caused by the release of contaminants at a site. Illinois EPA is currently operating a multiphase extraction (MPE) system to extract source material and a hydraulic containment system downgradient of the source material to prevent continued migration of contamination from Area 7. Groundwater is being monitored upgradient, within, and downgradient of Area 7 as part of OU2 and OU3.

1.1 Site Description

Rockford, Illinois, is located in the north-central portion of the state, approximately 75 miles northwest of Chicago. The SERGC site consists of contaminated groundwater resulting from the improper disposal of waste material at four known and identified sources, as shown in **Figure 1**.

Area 7 is primarily a grassy area located at the eastern end of Balsam Lane (**Figure 2**). Area 7 comprises Ekberg/Pine Manor Park and an open area containing some woodlands around the border. The park contains a basketball court and playground. The land surface slopes downward gently to the north toward an intermittent creek/drainage ditch that runs along the northern

edge of the property. Two swales in the southern half of the site are remnants of a former tributary that discharged to the creek along the north edge of the site. Beyond the creek, the site is bordered to the north by a railroad right-of-way. Residences border Area 7 to the west, southwest (downgradient), and east.

The geology of Area 7 consists of a heterogeneous assemblage of unconsolidated and discontinuous sands, silts, and clays that overlie dolomite bedrock. The bedrock surface is heavily weathered in places making it difficult to precisely define. An east-west trending buried bedrock valley roughly parallels the present-day creek. Groundwater flow in both the unconsolidated and bedrock aquifers is to the northwest, with localized discharge of shallow groundwater to the creek. Depth to groundwater ranges from approximately 40 feet at the south end of Area 7, about 10 to 15 feet in the central portion of the site, and less than 3 feet near the creek. The depth of ground to groundwater can vary significantly from one year to the next.

Monitoring well locations at the site are shown in **Figure 3** and a geologic cross section of the site is provided in **Figure 4**. The cross section was generated from lithologic information and analytical data from groundwater samples collected in April 2019 and using a three-dimensional model developed with Leapfrog Works software version 3.1. The model includes a visual representation of an aerial photograph draped over the topography. Visualizations of historical investigation locations, geologic stratigraphy, the water table, and the extent of chlorinated volatile organic compounds (VOC) in groundwater were created. The model was used to visualize the distribution of chlorinated VOCs and to generate a cross section that incorporates the April 2019 groundwater results. By overlaying multiple data sets within the model, the vertical and lateral extent of groundwater contamination at the site were visualized. Where applicable, the historical data associated with an investigation location were replaced with the most current data set to facilitate depiction.

1.2 Site History

Area 7 has a history of unregulated disposal activity, which is suspected to have begun as early as 1951 based on historical aerial photographs. Part of the history of this area includes former gravel pits; however, based on results of the various investigations performed at Area 7, it appears that most of the waste dumped at Area 7 was placed in and along the former tributaries that previously discharged to the creek on the north edge of the site.

In 1981, the City of Rockford discovered groundwater contamination at the property that eventually became part of the SERGC site. From 1981 to 1997, the Illinois EPA and the Illinois Department of Public Health (IDPH) performed investigations at the site that revealed that VOCs were present in soil and groundwater. During this and subsequent investigations, numerous contaminants of concern (COC) were identified, including 1,1-dichloroethene (1,1-DCE), 1,1,1-trichloroethane (TCA), 1,1,2-trichloroethane (1,1,2-TCA), trichloroethylene (TCE), tetrachloroethene (PCE), and carbon tetrachloride. The site was proposed for listing on the National Priorities List (NPL) in the Federal Register on June 24, 1988, and was formally added to the NPL on March 31, 1989, as a state-lead, federally funded Superfund site. The ROD for OU3 of the site was signed by Illinois EPA on May 8, 2002, and by the United States Environmental Protection Agency (USEPA) on June 11, 2002.

1.3 Investigation History

A brief summary of previous investigation activities at Area 7 follows, including significant findings of the remedial investigation/feasibility study (RI/FS), predesign) investigation activities, previous remedial actions conducted, and the current status of groundwater sampling.

1.3.1 Remedial Investigations and Feasibility Studies

The Phase I RI for the SERGC site was conducted from May through October 1991, and consisted primarily of a sitewide soil gas survey, monitoring well installation, and groundwater sampling and analysis to investigate multiple suspected source areas.

The investigation of a potential source in Area 7 was sparked by elevated concentrations of contaminants in the shallow monitoring well of a three-well cluster immediately downgradient of Area 7. Because elevated concentrations of contaminants were only found in the shallow well, it was assumed that the source was close to the well. A review of historical aerial photographs was conducted to identify site activities that were suspect. Based on the information from these tasks, additional field surveys were performed to identify potential areas of contamination within Area 7. These additional activities were conducted from March 1992 through May 1992 and included geophysical surveys and soil gas sampling. The geophysical surveys indicated several areas of subsurface anomalies that were subsequently investigated using soil gas sampling. Soil gas results indicated that high concentrations of VOCs, primarily TCA, were present in the subsurface, with the highest concentrations found in a north-south trending band along the western and northern valleys. The target compounds PCE and TCE were also detected in Area 7, with PCE being the second most abundant compound and TCE the least. During Phase II of the RI, additional work was conducted in Area 7, which consisted of a test-pit investigation, surface and subsurface soil sampling, and monitoring well installation.

The Phase II sitewide groundwater investigation, conducted concurrently, also indicated the same contaminant mix of TCA, PCE, and TCE downgradient, confirming that the subsurface in Area 7 was impacting sitewide groundwater. In August 1993, residential air sampling was conducted near Area 7 to determine if the soil and groundwater contamination was affecting indoor air quality in homes near the source. The VOCs detected in the indoor air samples were consistent with those detected in the soil gas but were not found to be present at concentrations above health-based guidelines. Additional indoor air sampling was conducted in Area 7 in July 2003 and was evaluated using more recently developed soil vapor intrusion modeling guidelines. This indoor air evaluation indicated that the migration pathways are generally inadequate or incomplete and do not result in indoor air concentrations at levels that present an unacceptable health risk.

The RI report for the sitewide groundwater investigation and source area identification was completed by CDM Smith and resulted in the signing of the OU2 ROD, which required additional extension of the City of Rockford municipal water system and selected natural attenuation, long-term groundwater monitoring, and source control measures that will be determined in the future under the SCOU.

The SCOU RI and focused feasibility study (FFS) reports were completed in July 2000. The SCOU FFS addressed contaminated soils, nonaqueous phase liquids (NAPL), and leachate, which were

considered to be the principal threat wastes and the primary causes of groundwater contamination at the four primary source areas. Alternatives developed in the SCOU FFS were separated into soil and leachate alternatives. To simplify the OU 3 ROD, technologies intended to contain and/or treat contaminated groundwater in the immediate vicinity of the four primary source areas were considered leachate alternatives.

According to the SCOU investigation results, elevated concentrations of toluene, ethyl benzene, xylenes, and chlorinated VOCs were found in Area 7 soils. The previous RI identified subsurface contamination along the drainage ditches in the southern portion of Area 7. The SCOU investigation confirmed that an additional hot spot area of soil contamination exists in and to the west and northwest of Ekberg Park. Elevated levels of VOCs were also found in the groundwater and in the surface water of the intermittent creek located on the property. Based on the soil and groundwater data, it was determined that the shallow groundwater from Area 7 locally discharges to the creek. Shallow groundwater downgradient of Area 7 contains elevated concentrations of TCA as the primary soil contaminant and lesser concentrations of various other VOCs. NAPLs were found in soil 11 feet below the groundwater table in a soil boring in the park. Additionally, Area 7 was found to have areas of highly contaminated silt and clay units, indicating that NAPLs have migrated into these fine-grained sediments.

1.3.2 Predesign Activities and Pilot Testing

Soil gas samples collected during the multiple phases of investigation at Area 7 indicated that the highest soil gas concentrations were found along the former valleys within Area 7, which extend from south to north as far as the intermittent creek. Contamination in soil gas to the north along the valley had not been previously delineated, and additional soil gas sampling to determine the extent of contamination to the north was performed as part of the Area 7 predesign activities. To the south, east, and west, VOC contamination in soil gas was delineated in the RI phase. To the west, which is the downgradient direction and the closest to area residences, soil gas concentrations reached nondetectable concentrations approximately 500 feet east of Bavarian Lane, which is the eastern most north-south street for the downgradient residential area.

The nature and extent of contamination at Area 7 was subsequently refined during predesign field studies that were conducted between August 2004 and June 2005 and documented in Technical Memorandum – Final, Southeast Rockford Groundwater Contamination Superfund Site, Source Area 7 Pre-Design Field Study, dated October 12, 2005. The technical memorandum is summarized the following sections.

1.3.2.1 Soil Gas

Soil gas sampling was conducted to further define the extent of subsurface VOC contamination in the northern portion of Area 7. Previous investigations did not fully confirm the extent of areas with VOC contamination in the subsurface to the north of the park and south of the creek. Additionally, the areas where recent dumping of debris had occurred were investigated to the extent practicable.

Results of the August 2004 soil gas sampling were consistent with the results of the previous soil gas surveys. The highest VOC concentrations were detected adjacent to the northwest corner of Ekberg/Pine Manor Park. As in the previous soil gas surveys, TCA was generally the most

abundant compound detected. These results indicate that the Area 7 source area extends approximately 100 feet north of Ekberg/Pine Manor Park.

1.3.2.2 Soil

Based on the results of the soil gas sampling, soil sampling locations were selected to define the extent of subsurface VOC contamination in the northern portion of Area 7. Evidence of free phase product and elevated concentrations of VOCs were observed in subsurface soils to the north of Ekberg/Pine Manor Park. Distribution of contaminants was consistent with the results of the soil gas sampling results and identified portions of the northernmost hot spot. The location of the northernmost hot spot identified in the August 2004 soil sampling was consistent with previous soil sampling.

1.3.2.3 Groundwater

Results of the groundwater investigation indicated that the distribution and concentration of contaminants within groundwater monitoring wells were generally similar to results from previous sampling investigations. The highest concentrations of VOCs were observed within the unconsolidated aquifer at monitoring well location MW-134A. Monitoring well MW-134A is located immediately downgradient of the area excavated for the hot spot removal RA described in Section 1.3.3.

Results of the groundwater sampling from wells (MW-135B, MW-143, MW-144, and MW-145) in the southern portion of Area 7 also showed significant downgradient VOC contamination. These results also indicated that the VOC source extended further to the south than previously believed. Additional groundwater monitoring wells were installed in August 2010 to define the southern extent of VOC groundwater contamination.

1.3.2.4 2005/2007 Geophysical Surveys

The first geophysical investigation was conducted during December 2005 only within Ekberg Park because of property access restrictions. The second investigation was conducted during December 2007 and included the remainder of Area 7.

Although previous geophysical surveys had been conducted at Area 7, the 2005 survey was conducted specifically to investigate the existence of a drainage tile reportedly installed through Area 7, which could be acting as a preferential pathway for contaminant migration through Area 7. The 2005 survey indicated the likely presence of the drainage tile, but also indicated the likely presence of source material in Ekberg Park that was subsequently confirmed and used as the pilot test and pump test location. Although the location of source material at Area 7 was generally known, the confirmation of source material with the geophysical survey was critical because the source material had not been so accurately and easily located during previous investigation activities at Area 7. Therefore, it was determined that the remainder of Area 7 should be surveyed.

The 2007 geophysical survey tentatively identified source material farther to the south and east of where it was previously thought to exist—almost to the southern property boundary of Area 7.

1.3.2.5 2007 Pilot Test and Pump Test

A predesign pilot study was conducted in Area 7 during May and June 2007 for use in preparation of the Area 7 RD. The work included the installation of groundwater extraction wells, piezometers, and vapor monitoring points; groundwater sampling; soil vapor extraction (SVE) testing; MPE testing; and aquifer property testing.

The pilot test performed in the area just to the west of the playground equipment revealed a large plume of soil and groundwater contamination. A pump test conducted in this area revealed that the subsurface consists of very fine-grained materials. Contamination was found between 4 and 15 feet below the ground surface, much shallower than previously encountered during earlier investigations. The nature of the fill and glacial deposits at this specific location and the soil borings indicated that the contamination would be held in place significantly longer than previously anticipated, due to the fine-grained materials.

1.3.2.6 2010 Predesign Subsurface Investigation

An additional predesign subsurface soil investigation was performed in August 2010 to fill the data gaps identified by the 2007 geophysical survey and to define the southern extent of soil and groundwater contamination. The investigation determined that subsurface contamination is present along the swales in the southern portion of the site at depths ranging from 12 to 40 feet below ground surface (bgs). The contamination is present above and below the water table, and the subsurface in these areas is characterized as heterogeneous with discontinuous layers of low-permeability materials.

1.3.3 Hot Spot Soil Removal Remedial Action

Illinois EPA conducted a limited hot spot soil removal excavation northwest of the playground to remove shallow, low-permeability source material that had been encountered during predesign investigation activities. The limited soil hot spot removal was performed in 2011 under an explanation of significant differences (ESD), signed by Illinois EPA on March 3, 2010, and by USEPA on May 3, 2010.

A total of 5,372 tons of VOC-impacted soils were removed from a 10,175-square-foot area. The outline and location of excavation is shown on an as-built drawing included in **Appendix A**. The excavation depth varied from 12 feet at the southern end to 8 feet at the northern end. The excavated area was backfilled with crushed aggregate to enhance the removal efficiency of the multiphase extraction system.

1.4 Area 7 Remediation System

Substantial completion of the Area 7 remediation system was achieved in May 2019 and then operated intermittently during startup testing until being declared operational and functional on November 5, 2019. The remediation system consists of 49 MPE wells, located in two groups where source material was conclusively identified, and 14 groundwater extraction wells, located along a north-south line downgradient of the Area 7 source areas. The MPE wells operate to remove source material, and the groundwater extraction wells operate as hydraulic containment to prevent the off-site migration of contaminated groundwater. Locations of the groundwater

extraction wells, MPE wells, and conveyance piping leading to the treatment building are shown on an as-built drawing included in **Appendix A**.

Contaminated media extracted from the subsurface is treated prior to on-site discharge. The treatment train consists of an oil-water separator, iron removal system, air stripper, bag filters, and carbon for both liquid and vapor streams. The liquid effluent is discharged to the on-site stream on the north edge of the site and vapor effluent is discharged to the atmosphere.

1.5 Groundwater Sampling Results

Analytical results for samples collected from the proposed Area 7 GMZ monitoring well network are provided in **Table 1**. The data are for samples collected in April 2019 before system startup, which serves as the baseline event, and in December 2019, just after the system was fully operational. In addition, analytical results from the upgradient monitoring well and downgradient wells MW-136 and MW-133A, B, and C are included. These wells are sampled by the City of Rockford under the OU2 RA; although these wells are not part of the proposed GMZ monitoring well network that will be sampled, analytical data from these wells will be used during the GMZ evaluation process. (Additional monitoring wells sampled by the City of Rockford are located further downgradient and may be incorporated into the GMZ data evaluation process.)

Analytical results include only those contaminants that have been detected at least once in samples collected from the proposed GMZ network monitoring wells for either the April 2019 baseline event or the December 2019 event. In **Table 1**, a number of results are reported as not analyzed (NA). Most of the NA designations are classified as such because the GMZ samples were analyzed pursuant to USEPA's tiered analytical approach in which different laboratories using slightly different parameter lists analyze samples from one sampling event to the next. In addition, the City of Rockford results for wells MW-133A, B, and C, and MW-136 are analyzed by yet another lab. However, because none of the subject contaminants are COCs, the difference in parameter lists will not present a data gap. Finally, the parameter 1,4-dioxane was added to the list of monitoring parameters at USEPA's request after the baseline sampling event in April and, historically, has not been analyzed by the laboratory used by the City of Rockford. However, for future sampling events, 1,4-dioxane will be analyzed for all samples.

The most common contaminants detected above the remediation goals (RG) are TCA, 1,1-DCA, cis-DCE, and PCE. Other compounds frequently detected above the RGs include TCE and vinyl chloride. The most contaminated wells are MW-105A and B, MW-134A, MW-135A, MW-144, and MW-145, which are screened in the unconsolidated formation, with the exception of MW-144, which is screened at the top of the weathered bedrock immediately below the unconsolidated zone. The downgradient well nest MW-103A, B, and C shows significant contamination at all three depths, indicating the contamination moves from the unconsolidated formation into the weathered bedrock downgradient of the site. Several wells located in the southern portion of Area 7 and screened in the weathered bedrock (MW-143, 147, 148, and 149) do not have any contaminants present above the RGs.

Results from the December 2019 groundwater sampling event conducted shortly after remediation system startup display modest reductions in contaminant concentrations in samples

collected from a number of monitoring wells. Although the reduction in concentrations may be the result of the remediation system, the limited amount of data does not support a conclusive determination at this time.

1.6 Document Overview

Pursuant to requirements of 35 IAC Part 620 Appendix D, the remainder of this GMZ application for Area 7 is presented in the following format:

- General facility information, including location, type of facility, geology and hydrogeology, and release history, is provided in Section 2.1.
- Release information, including a summary of the COCs, investigation activities, monitoring well network, groundwater monitoring dates, and results, is provided in Section 2.2.
- GMZ boundaries, including horizontal and vertical extent, are discussed in Section 2.3.
- Planned remedial actions are outlined in Section 2.4.
- Point of compliance wells are discussed in Section 2.5.

Section 2

Groundwater Management Zone Application

Applicable information to determine the adequacy of the controls and the management of the GMZ proposed for Area 7 are presented. The items are thoroughly addressed and provide the current information associated with the proposed GMZ.

Pursuant to 35 IAC Part 620.250, for a GMZ to be established, the groundwater within the proposed GMZ must be managed to mitigate impairment caused by the release of contaminants from a site. Source removal actions to prevent additional contamination from reaching groundwater must occur with groundwater management. Groundwater management to mitigate impairment can use various combinations of technology. These include techniques such as source removal and hydraulic containment. However, any action must improve the quality of groundwater caused by the release of contaminants from the site. A GMZ can only be approved for areas where groundwater improvement is occurring.

This GMZ application section is presented in the format required by the Illinois EPA.

2.1 General Facility Information

1. General information regarding the facility:

a. Facility name:

The GMZ is being established for Source Area 7 of the Southeast Rockford Groundwater Contamination Superfund site.

b. Facility address:

The facility address is 3840 Balsam Lane, Rockford, Illinois.

c. County in which facility is located:

The facility is located in Winnebago County.

d. Illinois EPA, Bureau of Land, and USEPA Identification Numbers:

The Illinois EPA identification number is 2010300074, and the USEPA identification number is ILD981000417.

e. A general description of the type of industry, products manufactured, raw materials used, location, and size of the facility, including SIC codes:

The environmental contamination at Area 7 is the result of past unregulated dumping. Historical aerial photographs indicate that unregulated disposal activities that occurred as early as 1951. Wastes were deposited within and near a former streambed that was subsequently filled. The wastes

disposed were produced by numerous generators engaged in many different types of operations and manufacturing activities.

Area 7 itself currently includes a public park (Ekberg/Pine Manor Park) surrounded by an open area with wooded areas along the edges. A small drainage ditch runs along the northern border of the site and residential areas lie to the east and west.

f. An identification of specific units (operating or closed) present at the facility for which the GMZ is proposed:

Because waste was disposed of at various locations of the site, the GMZ is proposed for all of Area 7.

g. A USGS topographic or county map showing the location of the site and a more detailed scaled map of the facility with each waste management unit identified in Item 1.f above. Map scale must be specific and the location of the facility must be provided with respect to Township, Section, and Range:

The location of the site is shown on a United States Geological Survey (USGS) 7.5-minute map for Rockford South, Illinois (1993) (**Figure 1**). The site layout of Area 7 is presented in **Figure 2**.

The facility is located in the southeast portion of the City of Rockford, Illinois, in Section 1 of Township 43 North, Range 1 East, of Rockford Township in Winnebago County. The surface elevation of Area 7 slopes downward to the north, ranging from approximately 850 feet down to 780 feet above mean sea level (MSL).

h. A description of the geology and hydrogeology within the proposed GMZ and the surrounding area:

The geology at Area 7 consists of a heterogeneous assemblage of unconsolidated and discontinuous sands, silts, and clays that unconformably overlie the Galena-Platteville dolomite bedrock. The bedrock surface is heavily weathered in places making it difficult to precisely define. An east-west trending buried glacial river valley roughly parallels the present-day creek. Unconsolidated material in the southern portion of the site is approximately 75 feet thick but increases significantly in thickness to the north and west as the eroded bedrock surface rapidly decreases in elevation.

Groundwater flow is to the northwest in both the unconsolidated and bedrock aquifers, with localized discharge of shallow groundwater to the creek. Depth to groundwater ranges from approximately 45 feet in the southern portion of the site, 15 feet in the central portion, to less than 3 feet near the creek on the north end of the site. Depth to groundwater is highly variable and can change up to 10 feet annually depending on precipitation.

i. Groundwater classification at the site:

Groundwater at the site is classified as Class I.

- j. *A description of the circumstances under which the release from each waste management unit, identified in Item 1.f above, to groundwater was identified:*

In 1981, the City of Rockford discovered groundwater contamination in the southeast portion of Rockford, which eventually became part of the SERGC site. Four municipal wells in southeast Rockford were removed from service in December 1981. From 1981 through 1997, Illinois EPA and IDPH performed investigations at the site that revealed that VOCs were present in soil and groundwater. During these various investigations, Area 7 was determined to be one of the SERGC site source areas.

2.2 Release Information

Results of various site investigations have documented the release of contaminants into the environment from Area 7.

2. *Information Regarding the Release, including:*

- a. *The chemical constituents released to the groundwater:*

The following chemical constituents have been detected in groundwater samples collected from monitoring wells at Area 7:

1,1,1-Trichloroethane	Isopropyl benzene
1,1,2,2-Tetrachloroethane	m,p-Xylene
1,1,2-Trichloroethane	Methyl Acetate
1,1-Dichloroethane	Methylcyclohexane
1,1-Dichloroethene	Methylene Chloride
1,2,4-Trimethylbenzene	Methyl-t-Butyl Ether
1,2-Dichlorobenzene	Naphthalene
1,2-Dichloroethane	n-Butylbenzene
1,3,5-Trimethylbenzene	n-Propylbenzene
1,4-Dioxane	o-Xylene
4-Methyl 2-Pentanone	Styrene
Acetone	Tetrachloroethene
Benzene	Toluene
Carbon Disulfide	trans-1,2-Dichloroethene
Chloroethane	Trichloroethene
Chloroform	Trichlorofluoromethane (Freon 11)
cis-1,2-Dichloroethene	Vinyl Chloride
Cymene	Xylenes - Total
Ethylbenzene	

- b. *Identification of the chemical constituents detected in groundwater that are above the applicable standard in 35 Ill. Adm. Code Part 620:*

The following chemical constituents have been detected in groundwater at concentrations that exceed Class I groundwater standards listed in 35 IAC 620.410:

- 1,1-Dichloroethene
- cis-1,2-Dichloroethene
- Trans-1,2-Dichloroethene
- 1,1-Dichloroethane
- 1,2-Dichloroethane
- Tetrachloroethene
- Benzene
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- Trichloroethene
- Vinyl Chloride
- 1,4-Dioxane

c. A description of how the site has been investigated to determine the source or sources of the release:

CDM Smith conducted the initial SERGC site field work under contract to Illinois EPA beginning in 1990. Subsequent RI and predesign investigations activities at Area 7 through to the present have included soil gas surveys, soil boring and sampling, monitoring well installation and sampling, indoor air studies, and pilot tests.

d. A description of how groundwater has been monitored to determine the rate and extent of the release:

Municipal water supply wells and monitoring wells in the SERGC site were installed and monitored in the 1980s. Wells were installed from the Rock River area in an eastward direction in an attempt to determine the upgradient source(s) of identified groundwater impacts. The investigation of a potential source in Area 7 was sparked by elevated concentrations of contaminants in the shallow monitoring well of a three-well cluster immediately downgradient of Area 7. Soil gas, soil, and groundwater sampling were performed to guide the placement of monitoring wells in and around Area 7 over the course of multiple investigations. As additional source areas within Area 7 were identified, additional monitoring wells were installed to evaluate the impact to groundwater due to the source material. Of the monitoring wells included in the GMZ monitoring network, the first monitoring wells were installed in 1991 and the last wells were installed in 2010.

The more recent monitoring well installations were associated with the remedial design for the soil and leachate remedial action, including wells upgradient and downgradient to monitor the effectiveness of the hydraulic containment and compliance with the proposed GMZ.

Details of the completed monitoring activities in Area 7 are provided in the following documents prepared by CDM Smith:

- Technical Memorandum for Phase I Field Activities, October 1992
- Southeast Rockford Final RI Report, January 1995
- Final Remedial Investigation Report for the Southeast Rockford Source Control Operable Unit, July 25, 2000
- Final Source Control Operable Unit Focused Feasibility Study, September 2000
- Source Area 7 Pre-Design Field Study Technical Memorandum, September 7, 2005
- Final Remedial Action Completion Report for Source Area 7 Hot Spot Removal, April 19, 2012
- Source Area 7 Remedial Design Operations and Maintenance Plan, October 2012
- Quality Assurance Project Plan (QAPP), Source Area 7 Groundwater Management Zone Monitoring Activities, December 15, 2020

These documents prepared by Nationwide Environmental Services, Inc. (NES) for the City of Rockford contain the information for the sitewide groundwater monitoring program:

- Quality Assurance Project Plan, Remedial Design/Remedial Action, Southeast Rockford Groundwater Contamination Site, March 2017
- Southeast Rockford Groundwater Contamination Site Groundwater Monitoring Report, Semi-Annual Monitoring Event – June 2019

e. A description of the groundwater monitoring network and groundwater sampling protocols in place at the facility:

The groundwater monitoring network consists of monitoring wells upgradient, within, and downgradient of the Area 7 contaminant source. The proposed groundwater monitoring network consists of 25 monitoring wells. The five monitoring wells within the GMZ boundary are considered upgradient of any source are MW-112A, MW-112B, MW-112C, MW-147, and MW-149. The monitoring wells within the proposed GMZ boundaries that are considered immediately downgradient of any source are MW-105A, MW-105B, MW-105C, MW-105D, MW-106A, MW-106B, MW-106C, MW-134A, MW-134B, MW-134C, MW-135A, MW-135B, MW-143, MW-144, MW-145, and MW-148. A more distant downgradient monitoring well nest is located approximately 1,400 feet west and downgradient of the GMZ boundary, and includes monitoring wells MW-103A, B, C, and D.

In addition, analytical data from several monitoring wells that are part of the sitewide groundwater monitoring performed by the City of Rockford will also be evaluated in conjunction with the GMZ monitoring well data. These wells include one well upgradient of Area 7 (MW-136) and one monitoring well nest (MW-133A, B, C) located downgradient of Area 7.

Details regarding these wells are listed in Section 2.2.g.ii of this document and the well locations are shown in **Figure 3**.

Groundwater samples are collected in accordance with CDM Smith's standard operating procedure for low-flow groundwater sampling provided in **Appendix B**. A complete description of the sampling and analysis procedures is provided in the Final Source Area 7 Groundwater Management Zone Monitoring Activities QAPP, dated December 15, 2020.

f. The schedule for monitoring of the groundwater:

GMZ monitoring activities began in early April 2019 with a baseline groundwater sampling event conducted prior to startup of any portion of the remediation system to provide a baseline for comparison with future groundwater sampling results. The remediation system was started for the first time in April 2019, operated intermittently for six months during startup testing, and began full-time operation in November 2019. The first round of GMZ sampling was conducted in December 2019.

As specified in the QAPP, groundwater sampling will be performed quarterly for at least five years to evaluate compliance with the GMZ and performance of the leachate treatment and hydraulic containment system. Groundwater quality will be compared to initial (baseline) results and will be evaluated for changes over time to determine the adequacy of the leachate controls implemented at Area 7.

The sitewide groundwater monitoring conducted by NES for the City of Rockford is conducted semi-annually. Their semi-annual sampling program began in 1999 and is projected to continue for 205 years according to the OU2 ROD. This groundwater data will be evaluated to determine groundwater plume changes over time that may result from the remedial activities at Area 7.

g. A summary of the results of groundwater monitoring associated with the release at each waste management unit identified in Item 1.f above. The summary of groundwater results should provide the following information:

1) Dates of sampling:

Multiple groundwater sampling events have occurred since investigation activities started at Area 7. Groundwater sampling events conducted by CDM Smith include the following:

- September through October 1991 (Phase I RI)
- October 1993 (Phase II RI)
- October 2004 (Predesign Field Study)
- June 2005 (Predesign Field Study)

- May through June 2007 (Predesign Pilot Study)
- October 2010 (Phase II Predesign Field Study)
- April 2019 (Baseline Groundwater Monitoring Event)
- December 2020 (First Quarterly Groundwater Monitoring Event)

Because the Area 7 monitoring wells have been installed over a period of time, not all existing Area 7 wells were monitored or sampled during each specific monitoring event.

Groundwater monitoring conducted by NES for the City of Rockford began in 1999 and has been conducted semi-annually to the present. This includes well nest MW-136, located upgradient of the Area 7 GMZ, and well nest MW-133, located downgradient of the Area 7 GMZ, as described in Section 2.2.e.

2) *Identification of monitoring wells:*

A list of the monitoring wells that have been used in the evaluation of groundwater at Area 7 is provided in **Table 2**.

3) *Chemical constituents analyzed and concentrations in parts per million (ppm) for each monitoring well identified in Item 2.g.ii above:*

The laboratory analytical results of the baseline and first-quarter groundwater monitoring event for Area 7 GMZ wells sampled by CDM Smith are provided **Table 1**. Results of the groundwater sampling performed by NES for the City of Rockford for MW-136 and MW-133A, B, and C that most closely coincide with CDM Smith sampling dates are also provided in **Table 1**.

2.3 Groundwater Management Zone Horizontal and Vertical Boundaries

3. *Scaled drawings identifying the horizontal and vertical boundaries of the proposed GMZ.*

Horizontal boundaries of the proposed GMZ are shown in **Figure 3**. As previously discussed, the proposed GMZ and site boundaries are the same.

The vertical boundary of the GMZ follows the bedrock surface as shown in **Figure 4**. The bedrock surface is proposed as the vertical limit of the GMZ because the bedrock surface is the generally accepted dividing line between OU2 (sitewide groundwater) and OU3 (source control).

2.4 Approved Remedial Action

4. *Information regarding the approved remedial action including:*

a. *A description of the approved remedial action:*

In 2011, Illinois EPA conducted a soil hot spot removal in the northwest corner of Ekberg/Pine Manor Park to remove 5,372 tons of VOC-impacted source material as shown on the drawing located in **Appendix A**.

In accordance with the OU3 ROD, the remedial action implemented at Source Area 7 comprises 49 MPE wells, located in two groups where source material was conclusively identified, and 14 groundwater extraction wells, located along a north-south line downgradient of the Area 7 source areas. The MPE wells operate to remove source material, and the groundwater extraction wells operate as hydraulic containment to prevent the off-site migration of contaminated groundwater. Locations of the groundwater extraction wells, MPE wells, and conveyance piping leading to the treatment building are shown on an as-built drawing included in **Appendix A**.

Contaminated media extracted from the subsurface is treated prior to on-site discharge. The treatment train consists of an oil-water separator, iron removal system, air stripper, bag filters, and carbon for both liquid and vapor streams with a designed capacity of 250 gallons per minute. The liquid effluent is discharged to the on-site stream on the north edge of the site and vapor effluent is discharged to the atmosphere.

b. A description of how the approved remedial action has impacted the release:

The soil hot spot removal conducted in 2011 under the ESD to the ROD allowed for an immediate reduction in source material that would augment and subsequently reduce the time required for the full-scale remediation to be implemented in accordance with the ROD. Although a detailed full-scale evaluation to quantify the source reduction has not been conducted, contaminant concentrations in groundwater immediately downgradient of the soil removal have improved significantly over time.

Monitoring well MW-134A is located immediately downgradient of the excavation footprint. Prior to the hot spot removal, MW-134A was last sampled in May 2007 and the concentration of total VOCs in the sample was 33,089 micrograms per liter ($\mu\text{g/L}$). However, for the sample collected in December 2019, the total VOC concentration was 13,037 $\mu\text{g/L}$.

The Area 7 remediation system, including leachate extraction, treatment, and hydraulic containment components, was substantially complete in May 2019. The system was operated during startup testing until being declared operational and functional on November 5, 2019. A baseline round of samples was collected from the proposed GMZ monitoring well network in April 2019 before system startup, and another round was collected in December 2019, about one month after the system was fully operational.

Although no conclusive determinations can be made based on data from only two sampling events, samples collected from monitoring wells located closest to the extraction wells do display significant reductions in contamination between the April and December 2019 sampling events. Samples collected from monitoring wells MW-144 and MW-145, located immediately downgradient of the extraction wells, have total VOC concentration reductions that are greater than 90 percent.

c. A description of how the approved remedial action is operated and maintained, a project schedule for completion of remediation:

Operation and maintenance (O&M) of the remediation system is performed by EnviroServe (formerly Bodine Environmental Services) under contract to Illinois EPA. O&M of the remediation

system will be performed in accordance with the O&M plan prepared by EnviroServe. Typical O&M activities will include the following:

- **Operations** — Equipment is expected to operate continuously with minimal operation and maintenance during the long-term operation in accordance with the equipment manufacturer's specifications, O&M requirements, and the approved O&M manual. The system is designed to run in automatic mode without further adjustments, with the exception of routine maintenance procedures, adjustments to optimize system performance, and system monitoring requirements. The extraction well pumps and treatment process pumps are automatically controlled with level controls. Pumps, wells, and other equipment will require periodic visitation and observation as well as normal routine lubrication and similar maintenance.
- **Monitoring** — Effluent monitoring is performed for both the liquid and vapor streams. The liquid effluent stream is sampled monthly, and the vapor effluent stream is sampled quarterly. Performance monitoring samples (e.g., influent, air stripper effluent, etc.) are also collected monthly to gauge the overall operating performance of the system and its individual components. For example, from December 2, 2019, to January 6, 2020, the treatment system removed 315 pounds (143 kilograms) of VOCs with a calculated removal efficiency of greater than 99.9 percent.
- **Routine Maintenance** — Maintenance of the system will occur on a regularly scheduled basis. Inspections will be made of sample ports and monitoring gauges, rotating parts, and accessories to check for dust and dirt accumulation, obstructions to air flow in inlet and outlet ductwork, and to determine if parts lubrication is necessary. Other routine maintenance will include removal and disposal of free product from the oil-water separator; bag filter replacement; cleaning or replacement of air stripper trays; and removal, disposal, and replacement of liquid and vapor phase carbon.
- **Major Maintenance** — Major maintenance, such as equipment replacement, will be required if that equipment fails. To keep major maintenance to a minimum, routine maintenance will be done as specified by the equipment manufacturer.

Based on modeling performed for the OU3 ROD, the length of time necessary to complete remediation is estimated to be 30 to 40 years.

d. An identification of any and all permits obtained from the Illinois EPA for the remedial action:

According to Section 121(e) of CERCLA and in the NCP of 40 CFR 300.400(e), no federal, state, or local permits are required for any remedial actions conducted entirely on-site. However, the RA is required to meet the substantive technical requirements of the applicable or relevant and appropriate requirements (ARARs) as if a permit were necessary. Emissions or discharges that leave the site, or RAs that are conducted off-site, are subject to applicable permitting requirements. A complete list of ARARs for the site is included in the OU3 ROD.

ARARs that would typically require a permit include the following:

- The construction of a groundwater treatment system in most cases requires a permit from the Division of Water Pollution Control. A burden of proof is placed upon the permittee to justify that the proposed treatment system is capable of meeting either the surface water discharge standards or general pretreatment standards for discharge to a sanitary sewer. It is also required that the selected remedy is the correct technology and design specifications are correct for the contaminants of concern.
- A National Pollutant Discharge Elimination System (NPDES) permit is required when a discharge is made to any surface water. The NPDES program provides for a nondegradation analysis of the receiving stream water quality analysis and a review of the parameters of concern to determine the appropriate limits and monitoring requirements. As discussed in the OU3 ROD, discharge limits are based on 35 IAC 302, Water Quality Standards. Specific water quality standards that apply to all waters of the state are listed in 35 IAC 302.208. For substances that do not have a numeric standard listed in 35 IAC 302.208, procedures for developing water quality criteria based on toxicity are provided in 35 IAC 302, Subpart F. Using these procedures, the Illinois EPA Bureau of Water has developed “derived criteria” for a number of different substances that do not have numeric standards.

The OU3 ROD contains a list of COCs with associated discharge limits; however, over time, several of the water quality standards have been revised and additional compounds that are not COCs have been detected in the influent. Therefore, discharge limits for the treatment system were evaluated and revised in late December 2020. The current effluent discharge limits are provided in **Table 3**.

- The Illinois air pollution control regulations were developed pursuant to the Federal Clean Air Act. The regulations contain specific emission levels and requirements for monitoring emissions. They contain regulations for specific types of operations (such as burning) and types of industry as well as permitting requirements. There are also specific emissions standards for hazardous air pollutants. Subchapter F, Part 232 provides information regarding toxic air contaminants and Subchapter L, Part 243 of these regulations give air quality standards.

e. A description of how groundwater at the facility will be monitored following the future completion of the remedy to ensure that the groundwater quality standards have been attained:

Groundwater samples will be collected from Area 7 GMZ monitoring wells on a quarterly basis for at least two years following completion of the remedy. After two years, the sampling frequency may be reduced to biannual sampling if results indicate steady or decreasing concentrations.

f. A discussion addressing the adequacy of the controls and management of the proposed GMZ at the site:

The groundwater within the GMZ will be actively managed and monitored in accordance with the processes and procedures outlined in the QAPP for Area 7 GMZ Monitoring Activities and the O&M Plan. These activities will include operations and maintenance of the remediation system

and sampling and analysis to document that the controls and management of the proposed GMZ continue to be adequate.

g. Course of action for future activities and/or request for modification in regard to the proposed GMZ at the site:

A written plan will be prepared and submitted to the Illinois EPA providing the rationale and justification if modifications to the GMZ became necessary. The submittal will be either a stand-alone document outlining significant modifications or part of annual reporting to define minor revisions.

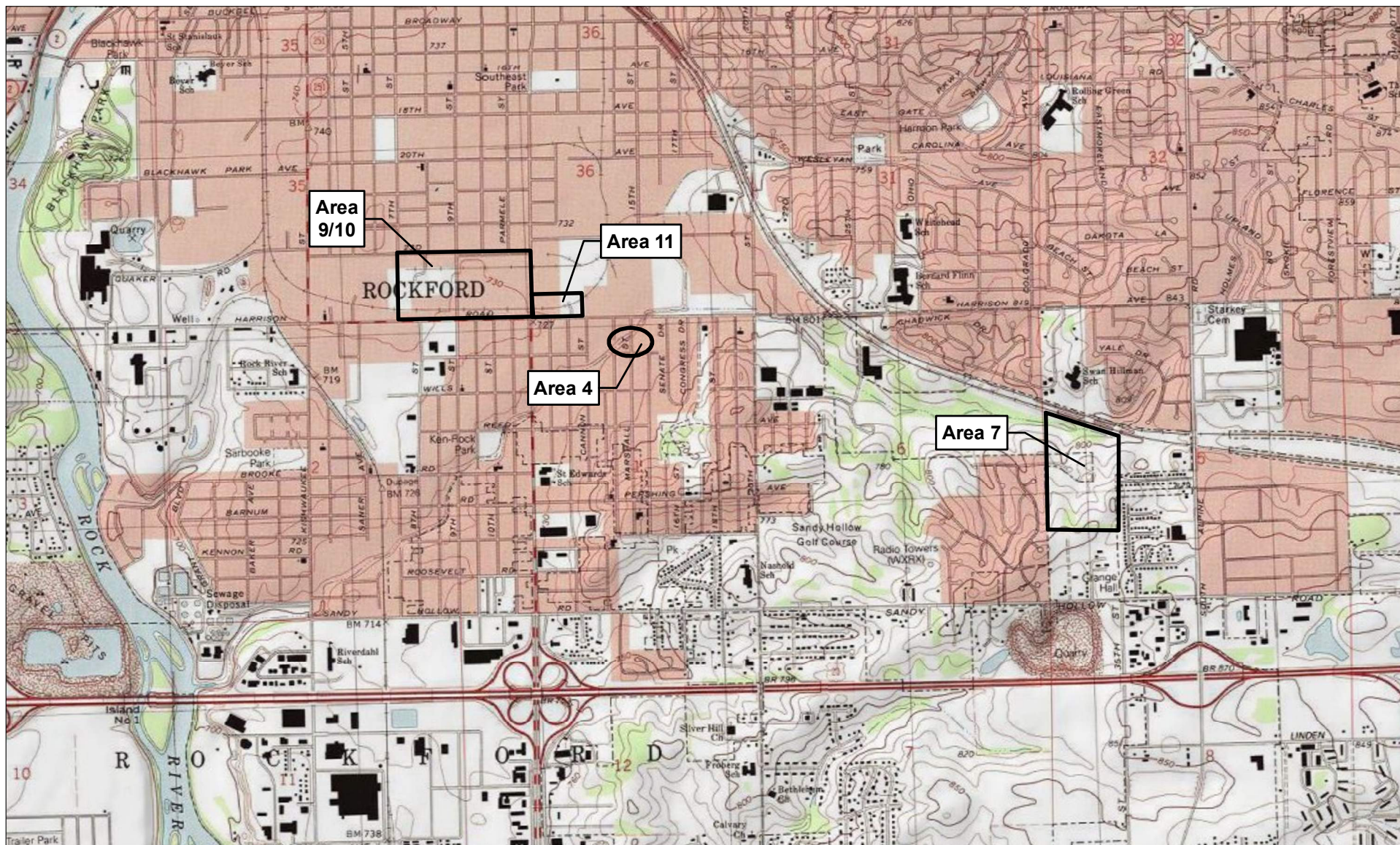
2.5 Point of Compliance

The downgradient well nest (MW-103A, B, C, and D) will be the primary point of compliance for the Area 7 RA. The locations of these wells are shown on **Figure 3**. Additional wells that also will be evaluated for compliance are the downgradient wells in nest MW-133A, B, and C. These wells are part of the semi-annual sitewide groundwater monitoring conducted by the City of Rockford. Analytical results from additional wells located further downgradient that are sampled by the City of Rockford also may be evaluated.

This page intentionally left blank.

Figures

This page intentionally left blank.

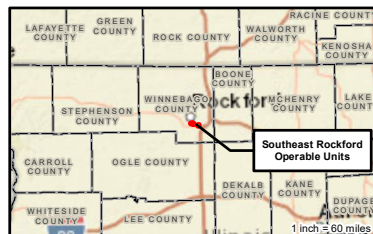


LEGEND

Source Area

Service Layer Credits:

- Aerial Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.
- Road Centerline Source: Census TIGER/Line Roads, 2020.



0 1,250 2,500
Feet

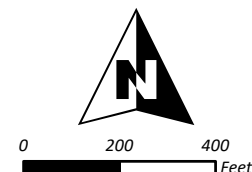


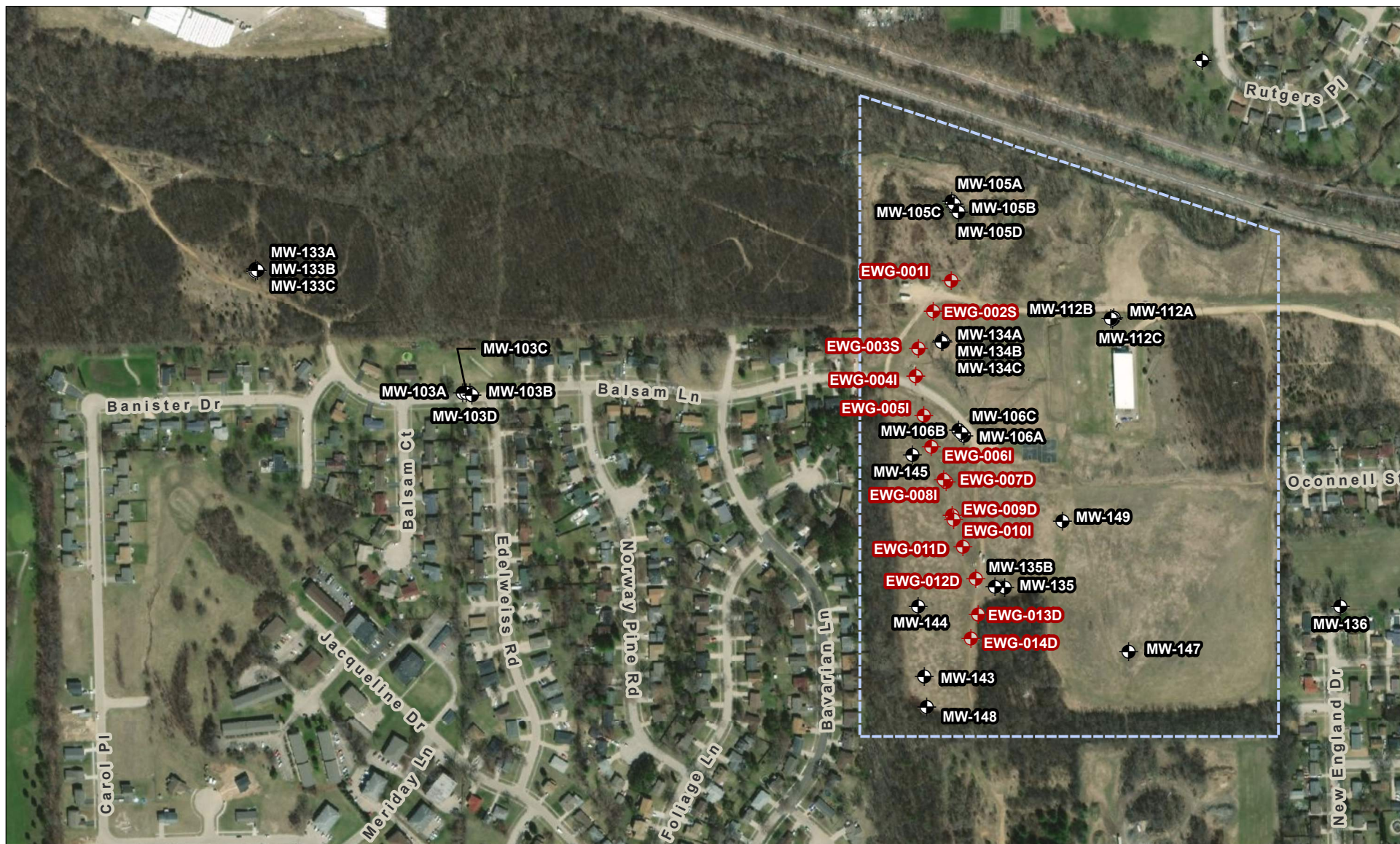
LEGEND

- +— Railroad
- Site Boundary




Service Layer Credits:

- Aerial Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.
- Road Centerline Source: Census TIGER/Line Roads, 2020.



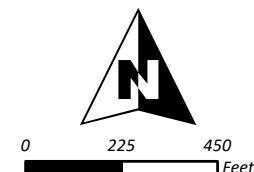


LEGEND

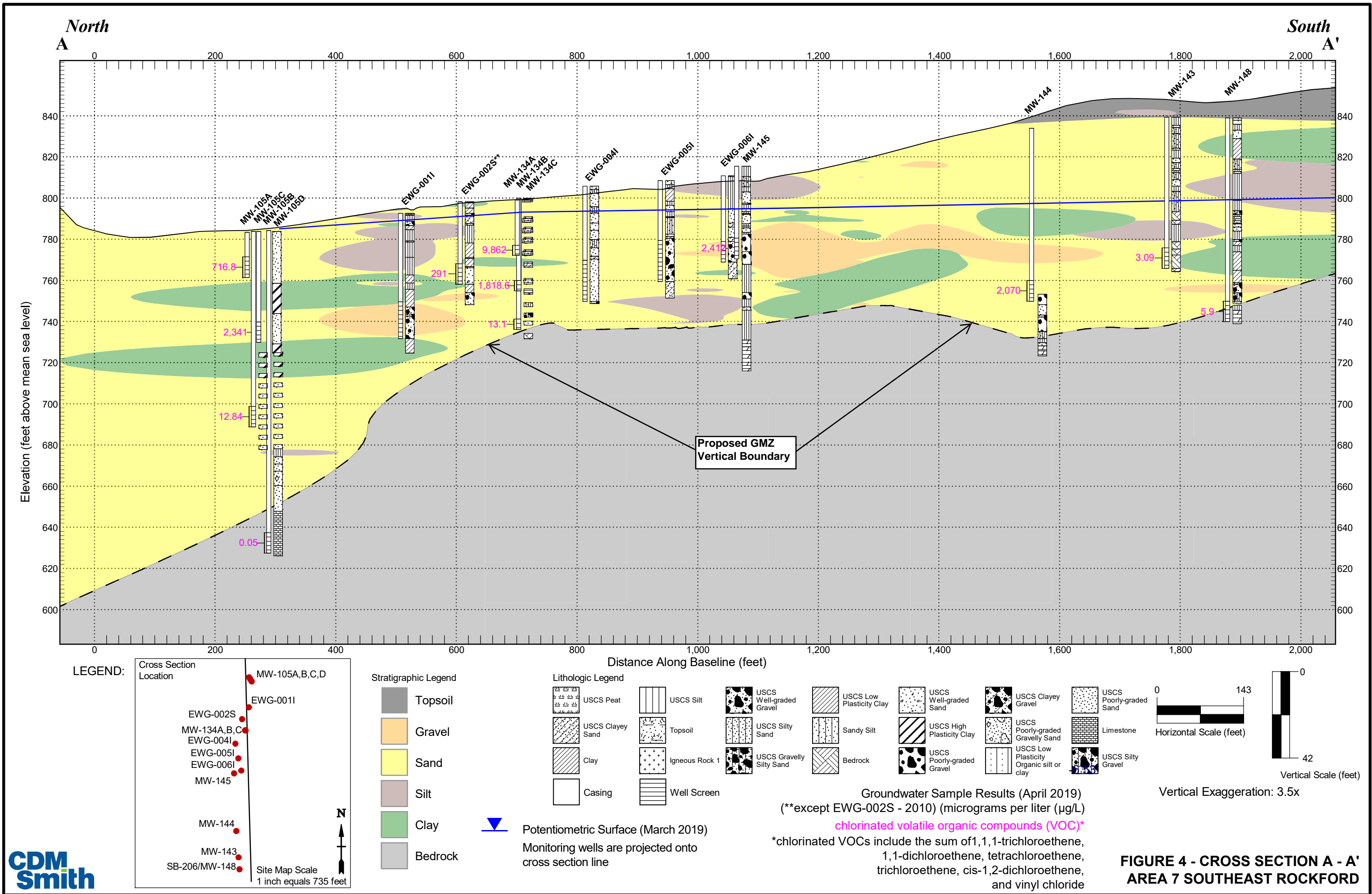
-  Monitoring Well
-  Extraction Well
-  GMZ and Site Boundary

Service Layer Credits:

- Aerial Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.
- Road Centerline Source: Census TIGER/Line Roads, 2020.



STANDARD CROSS SECTION: CIDRA REPORT: SERGC 2019.GPJ STANDARD_ENVIRONMENTAL_PROJECT.GDT 11/6/20 REV.



Tables

This page intentionally left blank.

TABLE 1
AREA 7 GROUNDWATER SAMPLING DATA
SOUTHEAST ROCKFORD

Station Location Sample ID Sample Date EPA Sample ID Sample Type		A7-MW-103A A7-MW103A-190403 4/3/2019 E3YE0 N	A7-MW-103A A7-MW103A-190403-D 4/3/2019 E3YE1 FD	A7-MW-103A A7-MW103A-191210 12/10/2019 N	A7-MW-103A A7-MW103A-191210-D 12/10/2019 FD	A7-MW-103B A7-MW103B-190403 4/3/2019 E3YE5 N	A7-MW-103B A7-MW103B-191211 12/11/2019 N	A7-MW-103C A7-MW103C-190403 4/3/2019 E3YE4 N	A7-MW-103C A7-MW103C-191211 12/11/2019 N	A7-MW-103D A7-MW103D-190402 4/2/2019 E3YD9 N
Analyte Name	RG									
1,1,1-Trichloroethane	200	200	170	128	130	480	390 J	360	332 J	4.5 J
1,1,2,2-Tetrachloroethane	--	5.0 U	5.0 U	2.00 U	4.00 U	5.0 U	2.00 U	5.0 U	2.00 U	5.0 U
1,1,2-Trichloroethane	5	0.53 J	0.60 J	2.00 U	4.00 U	3.0 J	2.23	2.9 J	2.88	5.0 U
1,1-Dichloroethane	1400	100	100	39.6	46.3	170	190	110	119	1.4 J
1,1-Dichloroethene	7	17	17	7.45 J	9.62 J	130 J+	126 J	120 J+	116 J	5.0 U
1,2,4-Trimethylbenzene	--	NA	NA	2.00 UJ	4.00 U	NA	2.00 U	NA	2.00 U	NA
1,2-Dichlorobenzene	600	5.0 U	5.0 U	2.00 UJ	4.00 U	5.0 U	2.00 U	5.0 U	2.00 U	5.0 U
1,2-Dichloroethane	5	5.0 U	5.0 U	2.00 U	4.00 U	5.0 U	2.00 U	1.8 J	2.00 U	5.0 U
1,3,5-Trimethylbenzene	--	NA	NA	2.00 UJ	4.00 U	NA	2.00 U	NA	2.00 U	NA
1,4-Dioxane	7.7	NA	NA	4.85	4.75	NA	6.15	NA	15	NA
4-Methyl 2-Pentanone	--	10 U	10 U	NA	NA	10 U	NA	10 U	NA	10 U
Acetone	6300	5.4 J	6.5 J	NA	NA	4.8 J	NA	4.7 J	NA	4.0 J
Benzene	5	5.0 U	5.0 U	2.00 UJ	4.00 U	5.0 U	2.00 U	5.0 U	2.00 U	5.0 U
Carbon Disulfide	700	5.0 U	5.0 U	NA	NA	5.0 U	NA	5.0 U	NA	5.0 U
Chloroethane	--	5.0 U	5.0 U	2.00 U	4.00 U	5.0 U	2.00 U	5.0 U	2.00 U	5.0 U
Chloroform	70	5.0 U	5.0 U	2.00 U	4.00 U	5.0 U	3.32	9.8	4.78	5.0 U
cis-1,2-Dichloroethene	70	370	500	258	236	150 J+	123	230	160	1.1 J
Cymene	--	NA	NA	2.00 UJ	4.00 U	NA	2.00 U	NA	2.00 U	NA
Ethyl Benzene	700	5.0 U	5.0 U	2.00 U	4.00 U	5.0 U	2.00 U	5.0 U	2.00 U	5.0 U
Isopropyl Benzene	700	5.0 U	5.0 U	2.00 UJ	4.00 U	5.0 U	2.00 U	5.0 U	2.00 U	5.0 U
Methyl Acetate	--	5.0 U	5.0 U	NA	NA	5.0 U	NA	5.0 U	NA	5.0 U
Methylcyclohexane	--	5.0 U	5.0 U	NA	NA	5.0 U	NA	5.0 U	NA	5.0 U
Methylene Chloride	5	5.0 U	5.0 U	2.00 U	4.00 U	5.0 U	2.00 U	5.0 U	2.00 U	5.0 U
Methyl-t-Butyl Ether	70	5.0 U	5.0 U	NA	NA	5.0 U	NA	5.0 U	NA	5.0 U
Naphthalene	140	NA	NA	2.00 UJ	4.00 U	NA	2.00 U	NA	2.00 U	NA
n-Butylbenzene	--	NA	NA	2.00 UJ	4.00 U	NA	2.00 U	NA	2.00 U	NA
n-Propylbenzene	--	NA	NA	2.00 UJ	4.00 U	NA	2.00 U	NA	2.00 U	NA
Styrene	100	5.0 U	5.0 U	2.00 U	4.00 U	5.0 U	2.00 U	5.0 U	2.00 U	5.0 U
Tetrachloroethene	5	20	20	11.7 J	11.6 J	67	75.8 J	75	76.1 J	5.0 U
Toluene	1000	5.0 U	5.0 U	2.00 UJ	4.00 U	5.0 U	2.00 U	5.0 U	2.00 U	5.0 U
trans-1,2-Dichloroethene	100	8	8.9	3.29	4.00 U	5.4 J+	4.89	3.1 J+	2.85	5.0 U
Trichloroethene	5	5	4.9 J	3.59	4.00 U	71	66.3	140	129	5.0 U
Trichlorofluoromethane (Freon 11)	2100	0.64 J	0.62 J	2.00 U	4.00 U	2.3 J	3.4	2.2 J	2.44	5.0 U
Vinyl Chloride	2	5.0 U	5.0 U	2.00 UJ	4.00 UJ	5.0 U	2.00 U	5.0 U	2.00 U	5.0 U
Xylenes - Total	10000	5.0 U	5.0 U	4.00 UJ	8.00 U	5.0 U	4.00 U	5.0 U	4.00 U	5.0 U

Notes:
All results in microgram per liter
Remediation goals from Record of Decision or 35 IAC 620
Shaded result exceeds remediation goal
* = Remediation goal from TACO (35 IAC 742)
U = Not detected above the reported limit
J = Estimated result
J+ = Estimated result-biased high
J- = Estimated result-biased low
R = Rejected
N = Investigative Sample
FD = Field Duplicate Sample
NA = Not Analyzed

TABLE 1
AREA 7 GROUNDWATER SAMPLING DATA
SOUTHEAST ROCKFORD

Station Location Sample ID Sample Date EPA Sample ID Sample Type		A7-MW-103D A7-MW103D-191210 12/10/2019 N	A7-MW-105A A7-MW105A-190403-D 4/3/2019 E3YD1 FD	A7-MW-105A A7-MW105A-190403 4/3/2019 E3YD2 N	A7-MW-105A A7-MW105A-191211 12/11/2019 N	A7-MW-105A A7-MW105A-191211-D 12/11/2019 FD	A7-MW-105B A7-MW105B-190403 4/3/2019 E3YD5 N	A7-MW-105B A7-MW105B-191211 12/11/2019 N	A7-MW-105C A7-MW105C-190403 4/3/2019 E3YC3 N	A7-MW-105C A7-MW105C-191212 12/12/2019 N
Analyte Name	RG									
1,1,1-Trichloroethane	200	4.16	80	82	121 J	125 J	300	191 J	0.50 U	2.00 U
1,1,2,2-Tetrachloroethane	--	2.00 U	0.50 U	0.50 U	2.00 U	2.00 U	5.0 U	4.00 U	0.50 U	2.00 U
1,1,2-Trichloroethane	5	2.00 U	0.67	0.68	2.00 U	2.00 U	1.7 J	4.00 U	0.50 U	2.00 U
1,1-Dichloroethane	1400	2.00 U	370	370	272	394	1100	747	6.2	8.04
1,1-Dichloroethene	7	2.00 U	6.7	6.4	5.37 J	5.44 J	5.0 U	12.6 J	0.50 U	2.00 U
1,2,4-Trimethylbenzene	--	2.00 U	NA	NA	2.00 U	2.00 U	NA	4.00 U	NA	2.00 U
1,2-Dichlorobenzene	600	2.00 U	0.50 U	0.50 U	2.00 U	2.00 U	5.0 U	4.00 U	0.50 U	2.00 U
1,2-Dichloroethane	5	2.00 U	4.4	4.2	3.07	2.96	9.8	9.92	11	4.2
1,3,5-Trimethylbenzene	--	2.00 U	NA	NA	2.00 U	2.00 U	NA	4.00 U	NA	2.00 U
1,4-Dioxane	7.7	2.47	NA	NA	NA	114	NA	NA	NA	NA
4-Methyl 2-Pentanone	--	NA	5.0 U	5.0 U	NA	NA	10 U	NA	5.0 U	NA
Acetone	6300	NA	5.2 U	6.2 U	NA	NA	2.6 J	NA	5.0 U	NA
Benzene	5	2.00 U	0.86	0.78	2.00 U	2.00 U	3.4 J	4.00 U	0.50 U	2.00 U
Carbon Disulfide	700	NA	0.50 U	0.50 U	NA	NA	5.0 U	NA	0.50 U	NA
Chloroethane	--	2.00 U	0.50 U	0.50 U	2.00 U	2.00 U	63	52.7	43	24.6
Chloroform	70	2.00 U	0.50 U	0.50 U	2.00 U	2.00 U	5.0 U	4.00 U	0.50 U	2.00 U
cis-1,2-Dichloroethene	70	2.00 U	450	450	306 J	444 J	1400	839	7.3	6.6
Cymene	--	2.00 U	NA	NA	2.00 U	2.00 U	NA	4.00 U	NA	2.00 U
Ethyl Benzene	700	2.00 U	0.50 U	0.50 U	2.00 U	2.00 U	5.0 U	4.00 UJ	0.50 U	2.00 U
Isopropyl Benzene	700	2.00 U	0.50 U	0.50 U	2.00 U	2.00 U	5.0 U	4.00 U	0.50 U	2.00 U
Methyl Acetate	--	NA	0.50 U	0.50 U	NA	NA	5.0 U	NA	0.50 U	NA
Methylcyclohexane	--	NA	0.50 U	0.50 U	NA	NA	5.0 U	NA	0.50 U	NA
Methylene Chloride	5	2.00 U	0.50 U	0.50 U	2.00 U	2.00 U	5.0 U	4.00 U	0.50 U	2.00 U
Methyl-t-Butyl Ether	70	NA	0.19 J	0.19 J	NA	NA	5.0 U	NA	0.50 U	NA
Naphthalene	140	2.00 U	NA	NA	2.00 U	2.00 U	NA	4.00 U	NA	2.00 U
n-Butylbenzene	--	2.00 U	NA	NA	2.00 U	2.00 U	NA	4.00 U	NA	2.00 U
n-Propylbenzene	--	2.00 U	NA	NA	2.00 U	2.00 U	NA	4.00 U	NA	2.00 U
Styrene	100	2.00 U	0.50 U	0.50 U	2.00 U	2.00 U	5.0 U	4.00 U	0.50 U	2.00 U
Tetrachloroethene	5	2.00 U	1.8	1.6	2.01 J	2.23 J	19	11.3 J	0.50 U	2.00 U
Toluene	1000	2.00 U	0.50 U	0.50 U	2.00 U	2.00 U	5.0 U	4.00 UJ	0.50 U	2.00 U
trans-1,2-Dichloroethene	100	2.00 U	13	13	10.1	10.2	36	30.1 J	0.27 J	2.00 U
Trichloroethene	5	2.00 U	7.1	6.8	9.14	8.79	22	22.7	0.14 J	2.00 U
Trichlorofluoromethane (Freon 11)	2100	2.00 U	0.50 U	0.50 U	2.00 U	2.00 U	5.0 U	4.00 U	0.50 U	2.00 U
Vinyl Chloride	2	2.00 UJ	160	170	195	179	600	253	5.4	6.31 J
Xylenes - Total	10000	4.00 U	0.50 U	0.50 U	4.00 U	4.00 U	5.0 U	8.00 U	0.50 U	2.00 U

Notes:
All results in microgram per liter
Remediation goals from Record of Decision or 35 IAC 620
Shaded result exceeds remediation goal
* = Remediation goal from TACO (35 IAC 742)
U = Not detected above the reported limit
J = Estimated result
J+ = Estimated result-biased high
J- = Estimated result-biased low
R = Rejected
N = Investigative Sample
FD = Field Duplicate Sample
NA = Not Analyzed

TABLE 1
AREA 7 GROUNDWATER SAMPLING DATA
SOUTHEAST ROCKFORD

Station Location Sample ID Sample Date EPA Sample ID Sample Type		A7-MW-105D A7-MW105D-190403 4/3/2019 E3YC5 N	A7-MW-105D A7-MW105D-191212 12/12/2019 N	A7-MW-106A A7-MW106A-190403 4/3/2019 E3YE2 N	A7-MW-106A A7-MW106A-191210 12/10/2019 N	A7-MW-106B A7-MW106B-190402 4/2/2019 E3YC7 N	A7-MW-106B A7-MW106B-191211 12/11/2019 N	A7-MW-106C A7-MW106C-190404 4/4/2019 E3YC4 N	A7-MW-106C A7-MW106C-191211 12/11/2019 N	A7-MW-112A A7-MW112A-190404 4/4/2019 E3YC6 N
Analyte Name	RG									
1,1,1-Trichloroethane	200	0.50 U	2.00 U	51	70.9	1.3	2.28 J	0.50 U	2.00 U	11
1,1,2,2-Tetrachloroethane	--	0.50 U	2.00 U	5.0 U	10.0 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
1,1,2-Trichloroethane	5	0.50 U	2.00 U	5.0 U	10.0 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
1,1-Dichloroethane	1400	0.35 J	2.00 U	600	162	0.37 J	2.00 U	0.50 U	2.00 U	1.2
1,1-Dichloroethene	7	0.50 U	2.00 U	5.0 U	10.0 U	0.50 U	2.00 UJ	0.50 U	2.00 UJ	0.45 J
1,2,4-Trimethylbenzene	--	NA	2.00 U	NA	496	NA	2.00 U	NA	2.00 U	NA
1,2-Dichlorobenzene	600	0.50 U	2.00 U	2.8 J	10.0 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
1,2-Dichloroethane	5	0.50 U	2.00 U	5.0 U	10.0 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
1,3,5-Trimethylbenzene	--	NA	2.00 U	NA	109	NA	2.00 U	NA	2.00 U	NA
1,4-Dioxane	7.7	NA	NA	NA	0.281	NA	NA	NA	NA	NA
4-Methyl 2-Pentanone	--	5.0 U	NA	10 U	NA	5.0 U	NA	5.0 U	NA	5.0 U
Acetone	6300	7.3 U	NA	4.0 J	NA	6.6 U	NA	6.7 U	NA	5.5 U
Benzene	5	0.50 U	2.00 U	5.0 U	10.0 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
Carbon Disulfide	700	0.50 U	NA	5.0 U	NA	0.50 U	NA	0.50 U	NA	0.50 U
Chloroethane	--	0.50 U	2.00 U	280	507	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
Chloroform	70	0.50 U	2.00 U	5.0 U	10.0 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
cis-1,2-Dichloroethene	70	0.50 U	2.00 U	420	10.0 U	1.7	2.73	0.50 U	2.00 U	0.64
Cymene	--	NA	2.00 U	NA	14.9	NA	2.00 U	NA	2.00 U	NA
Ethyl Benzene	700	0.50 U	2.00 U	15	43.2	0.50 U	2.00 UJ	0.50 U	2.00 UJ	0.50 U
Isopropyl Benzene	700	0.50 U	2.00 U	4.1 J	14.7	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
Methyl Acetate	--	0.50 U	NA	5.0 U	NA	0.50 U	NA	0.50 U	NA	0.50 U
Methylcyclohexane	--	0.50 U	NA	1.3 J	NA	0.50 U	NA	0.50 U	NA	0.50 U
Methylene Chloride	5	0.50 U	2.00 U	5.0 U	10.0 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
Methyl-t-Butyl Ether	70	0.50 U	NA	5.0 U	NA	0.50 U	NA	0.50 U	NA	0.50 U
Naphthalene	140	NA	2.00 U	NA	31.2	NA	2.00 U	NA	2.00 U	NA
n-Butylbenzene	--	NA	2.00 U	NA	11.2	NA	2.00 U	NA	2.00 U	NA
n-Propylbenzene	--	NA	2.00 U	NA	42.5	NA	2.00 U	NA	2.00 U	NA
Styrene	100	0.50 U	2.00 U	5.0 U	10.0 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
Tetrachloroethene	5	0.50 U	2.00 U	13	10.0 U	0.66	3.15 J	0.50 U	2.00 UJ	0.50 U
Toluene	1000	0.50 U	2.00 U	12	33.6	0.50 U	2.00 UJ	0.50 U	2.00 UJ	0.50 U
trans-1,2-Dichloroethene	100	0.50 U	2.00 U	2.0 J	10.0 U	0.21 J	2.00 UJ	0.50 U	2.00 UJ	0.50 U
Trichloroethene	5	0.50 U	2.00 U	3.5 J	10.0 U	0.97	2.86	0.50 U	2.00 U	0.43 J
Trichlorofluoromethane (Freon 11)	2100	0.50 U	2.00 U	5.0 U	10.0 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
Vinyl Chloride	2	0.50 U	2.00 UJ	33	10.0 UJ	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
Xylenes - Total	10000	0.50 U	4.00 U	54	222.2	0.50 U	4.00 U	0.27 J	4.00 U	0.50 U

Notes:
All results in microgram per liter
Remediation goals from Record of Decision or 35 IAC 620
Shaded result exceeds remediation goal
* = Remediation goal from TACO (35 IAC 742)
U = Not detected above the reported limit
J = Estimated result
J+ = Estimated result-biased high
J- = Estimated result-biased low
R = Rejected
N = Investigative Sample
FD = Field Duplicate Sample
NA = Not Analyzed

TABLE 1
AREA 7 GROUNDWATER SAMPLING DATA
SOUTHEAST ROCKFORD

Station Location Sample ID Sample Date EPA Sample ID Sample Type		A7-MW-112A A7-MW112A-191212 12/12/2019 N	A7-MW-112B A7-MW112B-190402 4/2/2019 E3YD0 N	A7-MW-112B A7-MW112B-191210 12/10/2019 N	A7-MW-112C A7-MW112C-190402 4/2/2019 E3YCO N	A7-MW-112C A7-MW112C-191210 12/10/2019 N	A7-MW-134A A7-MW134A-190404 4/4/2019 E3YE7 N	A7-MW-134A A7-MW134A-191212 12/12/2019 N	A7-MW-134B A7-MW134B-190404 4/4/2019 E3YD6 N	A7-MW-134B A7-MW134B-191210 12/10/2019 N
Analyte Name	RG									
1,1,1-Trichloroethane	200	8.43	0.15 J	2.00 U	0.15 J	2.00 U	3200	155	470	1600
1,1,2,2-Tetrachloroethane	--	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	5.0 U	4.00 U	5.0 U	10.0 U
1,1,2-Trichloroethane	5	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	12	4.00 U	5.0 U	10.0 U
1,1-Dichloroethane	1400	2.00 U	3.8	2.86	0.17 J	2.00 U	2200	149	920	1420
1,1-Dichloroethene	7	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	120 J+	13.8 J	23	48.2 J
1,2,4-Trimethylbenzene	--	2.00 U	NA	2.00 U	NA	2.00 U	NA	4.00 UJ	NA	319
1,2-Dichlorobenzene	600	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	22	4.00 UJ	5.0 U	20.4
1,2-Dichloroethane	5	2.00 U	0.91	2.00 U	0.50 U	2.00 U	11	4.00 U	4.2 J	10.0 U
1,3,5-Trimethylbenzene	--	2.00 U	NA	2.00 U	NA	2.00 U	NA	4.00 UJ	NA	64.4
1,4-Dioxane	7.7	NA	NA	17.3 J	NA	1.6	NA	NA	NA	11
4-Methyl 2-Pentanone	--	NA	5.0 U	NA	5.0 U	NA	10 U	NA	10 U	NA
Acetone	6300	NA	6.1 U	NA	7.4 U	NA	5.3 J	NA	3.8 J	NA
Benzene	5	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	8.3	4.00 UJ	1.2 J	10.0 U
Carbon Disulfide	700	NA	0.50 U	NA	0.50 U	NA	5.0 U	NA	5.0 U	NA
Chloroethane	--	2.00 U	1	2.00 U	0.50 U	2.00 U	230 J	23.9	190	286
Chloroform	70	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	5.0 U	4.00 U	5.0 U	10.0 U
cis-1,2-Dichloroethene	70	2.00 U	7.6	6.59	0.55	2.00 U	6200	255	1200	2540
Cymene	--	2.00 U	NA	2.00 U	NA	2.00 U	NA	4.00 UJ	NA	11.1
Ethyl Benzene	700	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	110	4.00 U	5.0 U	69.4
Isopropyl Benzene	700	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	19	4.00 UJ	5.0 U	14.8
Methyl Acetate	--	NA	0.50 U	NA	0.50 U	NA	5.0 U	NA	5.0 U	NA
Methylcyclohexane	--	NA	0.50 U	NA	0.50 U	NA	2.3 J	NA	5.0 U	NA
Methylene Chloride	5	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	4.8 J	4.00 U	0.72 J	10.0 U
Methyl-t-Butyl Ether	70	NA	0.50 U	NA	0.50 U	NA	5.0 U	NA	5.0 U	NA
Naphthalene	140	2.00 U	NA	2.00 U	NA	2.00 U	NA	4.00 UJ	NA	20.9
n-Butylbenzene	--	2.00 U	NA	2.00 U	NA	2.00 U	NA	4.00 UJ	NA	13.2
n-Propylbenzene	--	2.00 U	NA	2.00 U	NA	2.00 U	NA	4.00 UJ	NA	36.3
Styrene	100	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	5.0 U	4.00 U	5.0 U	28.9
Tetrachloroethene	5	2.00 U	0.22 J	2.00 U	0.50 U	2.00 U	16	14.6 J	9.5	12.7 J
Toluene	1000	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	52	4.00 UJ	5.0 U	44.5
trans-1,2-Dichloroethene	100	2.00 U	0.22 J	2.00 U	0.50 U	2.00 U	130 J+	13.8	21	45.9
Trichloroethene	5	2.00 U	0.72	2.00 U	0.16 J	2.00 U	66	6.6	6.1	18.8
Trichlorofluoromethane (Freon 11)	2100	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	5.0 U	4.00 U	5.0 U	10.0 U
Vinyl Chloride	2	2.00 UJ	0.35 J	2.00 UJ	0.50 U	2.00 UJ	260	5.16 J	110	585 J
Xylenes - Total	10000	4.00 U	0.50 U	4.00 U	0.50 U	4.00 U	450 J	8.00 UJ	5.0 U	330

Notes:
All results in microgram per liter
Remediation goals from Record of Decision or 35 IAC 620
Shaded result exceeds remediation goal
* = Remediation goal from TACO (35 IAC 742)
U = Not detected above the reported limit
J = Estimated result
J+ = Estimated result-biased high
J- = Estimated result-biased low
R = Rejected
N = Investigative Sample
FD = Field Duplicate Sample
NA = Not Analyzed

TABLE 1
AREA 7 GROUNDWATER SAMPLING DATA
SOUTHEAST ROCKFORD

Station Location Sample ID Sample Date EPA Sample ID Sample Type		A7-MW-134C A7-MW134C-190402 4/2/2019 E3YC9 N	A7-MW-134C A7-MW134C-190402-D 4/2/2019 E3YC8 FD	A7-MW-134C A7-MW134C-191210 12/10/2019 N	A7-MW-135A A7-MW135A-190403 4/3/2019 E3YD4 N	A7-MW-135B A7-MW135B-190402 4/2/2019 E3YD8 N	A7-MW-135B A7-MW135B-191211 12/11/2019 N	A7-MW-135B A7-MW135B-191211-D 12/11/2019 FD	A7-MW-143 A7-MW143-190403 4/3/2019 E3YD3 N	A7-MW-143 A7-MW143-191211 12/11/2019 N
Analyte Name	RG									
1,1,1-Trichloroethane	200	4.4	4.5	10.1	11000	13	18.8 J	17.3 J	2.4	17.9 J
1,1,2,2-Tetrachloroethane	--	0.50 U	0.50 U	2.00 U	2.6 J+	5.0 U	2.00 U	2.00 U	0.50 U	2.00 U
1,1,2-Trichloroethane	5	0.50 U	0.50 U	2.00 U	3.7	5.0 U	2.00 U	2.00 U	0.50 U	2.00 U
1,1-Dichloroethane	1400	8	8.3	18.3	390	6.7	11.4	10.6	0.26 J	2.00 U
1,1-Dichloroethene	7	1.2	1.2	2.57 J	210 J-	5.0 U	2.00 UJ	2.00 UJ	0.50 U	2.00 UJ
1,2,4-Trimethylbenzene	--	NA	NA	2.00 U	NA	NA	2.00 U	2.00 U	NA	2.00 U
1,2-Dichlorobenzene	600	0.50 U	0.50 U	2.00 U	0.16 J	5.0 U	2.00 U	2.00 U	0.50 U	2.00 U
1,2-Dichloroethane	5	0.56	0.54	2.00 U	0.50 U	5.0 U	2.00 U	2.00 U	0.50 U	2.00 U
1,3,5-Trimethylbenzene	--	NA	NA	2.00 U	NA	NA	2.00 U	2.00 U	NA	2.00 U
1,4-Dioxane	7.7	NA	NA	24.9	NA	NA	NA	NA	NA	0.202 U
4-Methyl 2-Pentanone	--	5.0 U	5.0 U	NA	5.0 U	10 U	NA	NA	5.0 U	NA
Acetone	6300	5.0 U	5.0 U	NA	5.0 U	4.1 J	NA	NA	7 U	NA
Benzene	5	0.50 U	0.50 U	2.00 U	4.6	5.0 U	2.00 U	2.00 U	0.50 U	2.00 U
Carbon Disulfide	700	0.50 U	0.50 U	NA	0.43 J	5.0 U	NA	NA	0.50 U	NA
Chloroethane	--	0.50 U	0.50 U	2.00 U	0.50 U	5.0 U	2.00 U	2.00 U	0.50 U	2.00 U
Chloroform	70	0.50 U	0.50 U	2.00 U	0.50 U	5.0 U	2.00 U	2.00 U	0.50 U	2.00 U
cis-1,2-Dichloroethene	70	3.2	3.3	6.69	4800 J-	8.6	25.2	23.8	0.34 J	2.00 U
Cymene	--	NA	NA	2.00 U	NA	NA	2.00 U	2.00 U	NA	2.00 U
Ethyl Benzene	700	0.50 U	0.50 U	2.00 U	5.5	5.0 U	2.00 UJ	2.00 UJ	0.50 U	2.00 UJ
Isopropyl Benzene	700	0.50 U	0.50 U	2.00 U	1	5.0 U	2.00 U	2.00 U	0.50 U	2.00 U
Methyl Acetate	--	0.50 U	0.50 U	NA	0.50 U	5.0 U	NA	NA	0.50 U	NA
Methylcyclohexane	--	0.50 U	0.50 U	NA	0.50 U	5.0 U	NA	NA	0.50 U	NA
Methylene Chloride	5	0.50 U	0.50 U	2.00 U	0.50 U	5.0 U	2.00 U	2.00 U	0.50 U	2.00 U
Methyl-t-Butyl Ether	70	0.50 U	0.50 U	NA	0.50 U	5.0 U	NA	NA	0.50 U	NA
Naphthalene	140	NA	NA	2.00 U	NA	NA	2.00 U	2.00 U	NA	2.00 U
n-Butylbenzene	--	NA	NA	2.00 U	NA	NA	2.00 U	2.00 U	NA	2.00 U
n-Propylbenzene	--	NA	NA	2.00 U	NA	NA	2.00 U	2.00 U	NA	2.00 U
Styrene	100	0.50 U	0.50 U	2.00 U	0.50 U	5.0 U	2.00 U	2.00 U	0.50 U	2.00 U
Tetrachloroethene	5	2.2	2.3	3.57 J	160 J-	24	16.5 J	16.8 J	0.35 J	2.00 UJ
Toluene	1000	0.50 U	0.50 U	2.00 U	13	5.0 U	2.00 UJ	2.00 UJ	0.50 U	2.00 UJ
trans-1,2-Dichloroethene	100	0.50 U	0.50 U	2.00 U	42 J-	2.2 J	4.23 J	4.35 J	0.50 U	2.00 UJ
Trichloroethene	5	2.1	2.2	3.93	100 UJ	8.1	19.6	19.3	0.50 U	2.00 U
Trichlorofluoromethane (Freon 11)	2100	0.50 U	0.50 U	2.00 U	4.8	5.0 U	2.00 U	2.00 U	0.50 U	2.00 U
Vinyl Chloride	2	0.50 U	0.50 U	2.00 UJ	2	5.0 U	2.00 U	2.00 U	0.50 U	2.00 U
Xylenes - Total	10000	0.50 U	0.50 U	4.00 U	87.7 J-	5.0 U	4.00 U	4.00 U	0.50 U	4.00 U

Notes:
All results in microgram per liter
Remediation goals from Record of Decision or 35 IAC 620
Shaded result exceeds remediation goal
* = Remediation goal from TACO (35 IAC 742)
U = Not detected above the reported limit
J = Estimated result
J+ = Estimated result-biased high
J- = Estimated result-biased low
R = Rejected
N = Investigative Sample
FD = Field Duplicate Sample
NA = Not Analyzed

TABLE 1
AREA 7 GROUNDWATER SAMPLING DATA
SOUTHEAST ROCKFORD

Station Location		A7-MW-144	A7-MW-144	A7-MW-145	A7-MW-145	A7-MW147	A7-MW147	A7-MW-148	A7-MW-148	A7-MW-149
Sample ID		A7-MW144-190404	A7-MW144-191211	A7-MW145-190404	A7-MW145-191212	A7-MW147-190402	A7-MW147-191211	A7-MW148-190403	A7-MW148-191210	A7-MW149-190402
Sample Date		4/4/2019	12/11/2019	4/4/2019	12/12/2019	4/2/2019	12/11/2019	4/3/2019	12/10/2019	4/2/2019
EPA Sample ID		E3YE3		E3YE6		E3YB9		E3YC1		E3YC2
Sample Type		N	N	N	N	N	N	N	N	N
Analyte Name	RG									
1,1,1-Trichloroethane	200	1600	116 J	520	32.7	0.50 U	2.00 U	1.1 J+	2.00 U	0.50 U
1,1,2,2-Tetrachloroethane	--	5.0 U	2.00 U	5.0 U	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
1,1,2-Trichloroethane	5	4.8 J	2.00 U	5.0 U	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
1,1-Dichloroethane	1400	84	5.06	940	42.2	0.50 U	2.00 U	0.35 J	2.00 U	0.50 U
1,1-Dichloroethene	7	37	2.80 J	34	2.00 U	0.50 U	2.00 UJ	0.50 U	2.00 U	0.50 U
1,2,4-Trimethylbenzene	--	NA	2.00 U	NA	2.00 U	NA	2.00 U	NA	2.00 U	NA
1,2-Dichlorobenzene	600	5.0 U	2.00 U	5.0 U	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
1,2-Dichloroethane	5	5.0 U	2.00 U	2.9 J	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
1,3,5-Trimethylbenzene	--	NA	2.00 U	NA	2.00 U	NA	2.00 U	NA	2.00 U	NA
1,4-Dioxane	7.7	NA	0.202 U	NA	NA	NA	NA	NA	0.202	NA
4-Methyl 2-Pentanone	--	10 U	NA	1.2 J	NA	5.0 U	NA	5.0 U	NA	5.0 U
Acetone	6300	5.0 J	NA	4.4 J	NA	5.4 U	NA	7 U	NA	10 U
Benzene	5	5.0 U	2.00 U	1.3 J	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
Carbon Disulfide	700	5.0 U	NA	5.0 U	NA	0.50 U	NA	0.50 U	NA	0.50 U
Chloroethane	--	5.0 U	2.00 U	160	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
Chloroform	70	5.0 U	2.00 U	5.0 U	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
cis-1,2-Dichloroethene	70	290	7.56	1700	18.7	0.50 U	2.00 U	1.5	2.00 U	0.50 U
Cymene	--	NA	2.00 U	NA	2.00 U	NA	2.00 U	NA	2.00 U	NA
Ethyl Benzene	700	5.0 U	2.00 UJ	21	2.00 U	0.50 U	2.00 UJ	0.50 U	2.00 U	0.50 U
Isopropyl Benzene	700	5.0 U	2.00 U	2.7 J	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
Methyl Acetate	--	5.0 U	NA	1.3 J	NA	0.50 U	NA	0.50 U	NA	0.50 U
Methylcyclohexane	--	5.0 U	NA	0.68 J	NA	0.50 U	NA	0.50 U	NA	0.50 U
Methylene Chloride	5	5.0 U	2.00 U	5.0 U	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
Methyl-t-Butyl Ether	70	5.0 U	NA	5.0 U	NA	0.50 U	NA	0.21 J+	NA	0.50 U
Naphthalene	140	NA	2.00 U	NA	2.00 U	NA	2.00 U	NA	2.00 U	NA
n-Butylbenzene	--	NA	2.00 U	NA	2.00 U	NA	2.00 U	NA	2.00 U	NA
n-Propylbenzene	--	NA	2.00 U	NA	2.00 U	NA	2.00 U	NA	2.00 U	NA
Styrene	100	5.0 U	2.00 U	5.0 U	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
Tetrachloroethene	5	110	8.03 J	6	2.00 U	0.24 J	2.00 UJ	1.8	2.00 U	0.50 U
Toluene	1000	5.0 U	2.00 UJ	34	2.00 U	0.50 U	2.00 UJ	0.50 U	2.00 U	0.50 U
trans-1,2-Dichloroethene	100	2.2 J	2.00 UJ	12	2.00 U	0.50 U	2.00 UJ	0.22 J	2.00 U	0.50 U
Trichloroethene	5	33	2.00 U	2.0 J	2.00 U	0.50 U	2.00 U	1.5	2.00 U	0.50 U
Trichlorofluoromethane (Freon 11)	2100	0.91 J	2.00 U	5.0 U	2.00 U	0.50 U	2.00 U	0.50 U	2.00 U	0.50 U
Vinyl Chloride	2	5.0 U	2.00 U	150	2.00 UJ	0.50 U	2.00 U	0.50 U	2.00 UJ	0.50 U
Xylenes - Total	10000	5.0 U	4.00 U	117	4.00 U	0.50 U	4.00 U	0.50 U	4.00 U	0.50 U

Notes:
All results in microgram per liter
Remediation goals from Record of Decision or 35 IAC 620
Shaded result exceeds remediation goal
* = Remediation goal from TACO (35 IAC 742)
U = Not detected above the reported limit
J = Estimated result
J+ = Estimated result-biased high
J- = Estimated result-biased low
R = Rejected
N = Investigative Sample
FD = Field Duplicate Sample
NA = Not Analyzed

TABLE 1
AREA 7 GROUNDWATER SAMPLING DATA
SOUTHEAST ROCKFORD

Station Location		A7-MW-149	A7-MW-133A	A7-MW-133A	A7-MW-133B	A7-MW-133B	A7-MW-133C	A7-MW-133C	A7-MW-136	A7-MW-136
Sample ID		A7-MW149-191210	50228831018	50244738011	50228831019	50244738012	50228831020	50244738013	50228174001	50244211008
Sample Date		12/10/2019	6/23/2019	12/14/2019	6/23/2019	12/14/2019	6/23/2019	12/14/2019	6/15/2019	12/8/2019
EPA Sample ID			50228831018	50244738011	50228831019	50244738012	50228831020	50244738013	50228174001	50244211008
Sample Type		N	N	N	N	N	N	N	N	N
Analyte Name	RG									
1,1,1-Trichloroethane	200	2.00 U	1.0 U	4	300	241	103	83.4	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	--	2.00 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	5	2.00 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	1400	2.00 U	1.0 U	1.0 U	1.0 U	90.7	42	38.9	1.0 U	1.0 U
1,1-Dichloroethene	7	2.00 U	1.0 U	1.0 U	37.4	41	30.6	31.1	1.0 U	1.0 U
1,2,4-Trimethylbenzene	--	2.00 U	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	600	2.00 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	5	2.00 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	--	2.00 U	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dioxane	7.7	0.202 U	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl 2-Pentanone	--	NA	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U
Acetone	6300	NA	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U
Benzene	5	2.00 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon Disulfide	700	NA	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chloroethane	--	2.00 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	70	2.00 U	1.0 U	1.0 U	1.7	1.8	3	2.8	1.0 J	1.0 U
cis-1,2-Dichloroethene	70	2.07	1.0 U	1.0 U	31.6	31.2	44	37.3	1.0 J	1.0 U
Cymene	--	2.00 U	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl Benzene	700	2.00 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropyl Benzene	700	2.00 U	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Acetate	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylcyclohexane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	5	2.00 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Methyl-t-Butyl Ether	70	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	140	2.00 U	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene	--	2.00 U	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene	--	2.00 U	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	100	2.00 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	5	2.00 U	1.0 U	1.0 U	44.4	40.7	11.5	13.8	1.0 U	1.0 U
Toluene	1000	2.00 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	100	2.00 U	1.0 U	1.0 U	4.3	3.6	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	5	2.00 U	1.0 U	1.0 U	23.4	22.1	53.7	46.3	1.0 U	1.0 U
Trichlorofluoromethane (Freon 11)	2100	2.00 U	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	2	2.00 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylenes - Total	10000	4.00 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U

Notes:
All results in microgram per liter
Remediation goals from Record of Decision or 35 IAC 620
Shaded result exceeds remediation goal
* = Remediation goal from TACO (35 IAC 742)
U = Not detected above the reported limit
J = Estimated result
J+ = Estimated result-biased high
J- = Estimated result-biased low
R = Rejected
N = Investigative Sample
FD = Field Duplicate Sample
NA = Not Analyzed

TABLE 2
AREA 7 GMZ MONITORING WELL CONSTRUCTION SUMMARY
SOUTHEAST ROCKFORD

Well No.	Screened Interval (bgs)	Aquifer Screened
MW-103A	31 – 41	unconsolidated
MW-103B	65 – 75	bedrock
MW-103C	97.9 - 107.9	bedrock
MW-103D	190.5 - 200.5	bedrock
MW-105A	12 – 22	unconsolidated
MW-105B	44 – 54	unconsolidated
MW-105C	85 – 95	unconsolidated
MW-105D	146.5 - 156.5	bedrock
MW-106A	30.5 - 40.5	unconsolidated
MW-106B	76.4 - 86.4	bedrock
MW-106C	109.4 - 119.4	bedrock
MW-112A	25 – 35	unconsolidated
MW-112B	85 – 95	bedrock
MW-112C	290 – 300	bedrock
MW-133A*	25-35	unconsolidated
MW-133B*	48-58	unconsolidated
MW-133C*	86-96	bedrock
MW-134A	23 – 28	unconsolidated
MW-134B	40 – 45	unconsolidated
MW-134C	58 – 63	unconsolidated
MW-135A	24 – 34	unconsolidated
MW-135B	70 – 80	bedrock
MW-136*	35-45	bedrock
MW-143	65 – 75	weathered bedrock
MW-144	75 – 85	weathered bedrock
MW-145	36 – 46	unconsolidated
MW-147	74 – 84	unconsolidated
MW-148	89 – 99	unconsolidated/weathered bedrock
MW-149	65 – 76	weathered bedrock

Notes:

bgs = below ground surface

* = Monitoring well sampled by City of Rockford under OU2.

TABLE 3
AREA 7 EFFLUENT DISCHARGE LIMITS
SOUTHEAST ROCKFORD

Chemical	Discharge Limit
carbon tetrachloride	0.28 mg/L
1,1-dichloroethylene	240 ug/L
1,2-dichloroethylene	1.1 mg/L
ethylbenzene	14 ug/L
tetrachloroethylene	0.15 mg/L
toluene	600 ug/L
1,1,1-trichloroethane	390 ug/L
1,1,2-trichloroethane	4.4 mg/L
trichloroethylene	0.94 mg/L
xylene	0.36 mg/L
n-butylbenzene	(3.1 ug/L)
sec-butylbenzene	(6.6 ug/L)
chloroethane	(1 mg/L)
1,1-dichloroethane	(2 mg/L)
1,2-dichlorobenzene	170 ug/L
1,2-dichloroethane	4.5 mg/L
1,4-dioxane	(36 mg/L)
p-isopropyltoluene	(6.8 ug/L)
4-methyl-2-pentanone	1.4 mg/L
naphthalene	68 ug/L
n-propylbenzene	(10 ug/L)
styrene	0.2 mg/L
1,2,4-trimethylbenzene	29 ug/L
1,3,5-trimethylbenzene	(11 ug/L)
vinyl chloride	1.7 mg/L

Sources:

[Illinois EPA, Section 302.208 Numeric Standards for Chemical Constituents
\(https://pcb.illinois.gov/documents/dsweb/Get/Document-33354/\)](https://pcb.illinois.gov/documents/dsweb/Get/Document-33354/)

[Illinois EPA Derived Water Quality Criteria
\(https://www2.illinois.gov/epa/Documents/epa.state.il.us/water/water-quality-standards/water-quality-criteria-list.pdf\)](https://www2.illinois.gov/epa/Documents/epa.state.il.us/water/water-quality-standards/water-quality-criteria-list.pdf)

Notes:

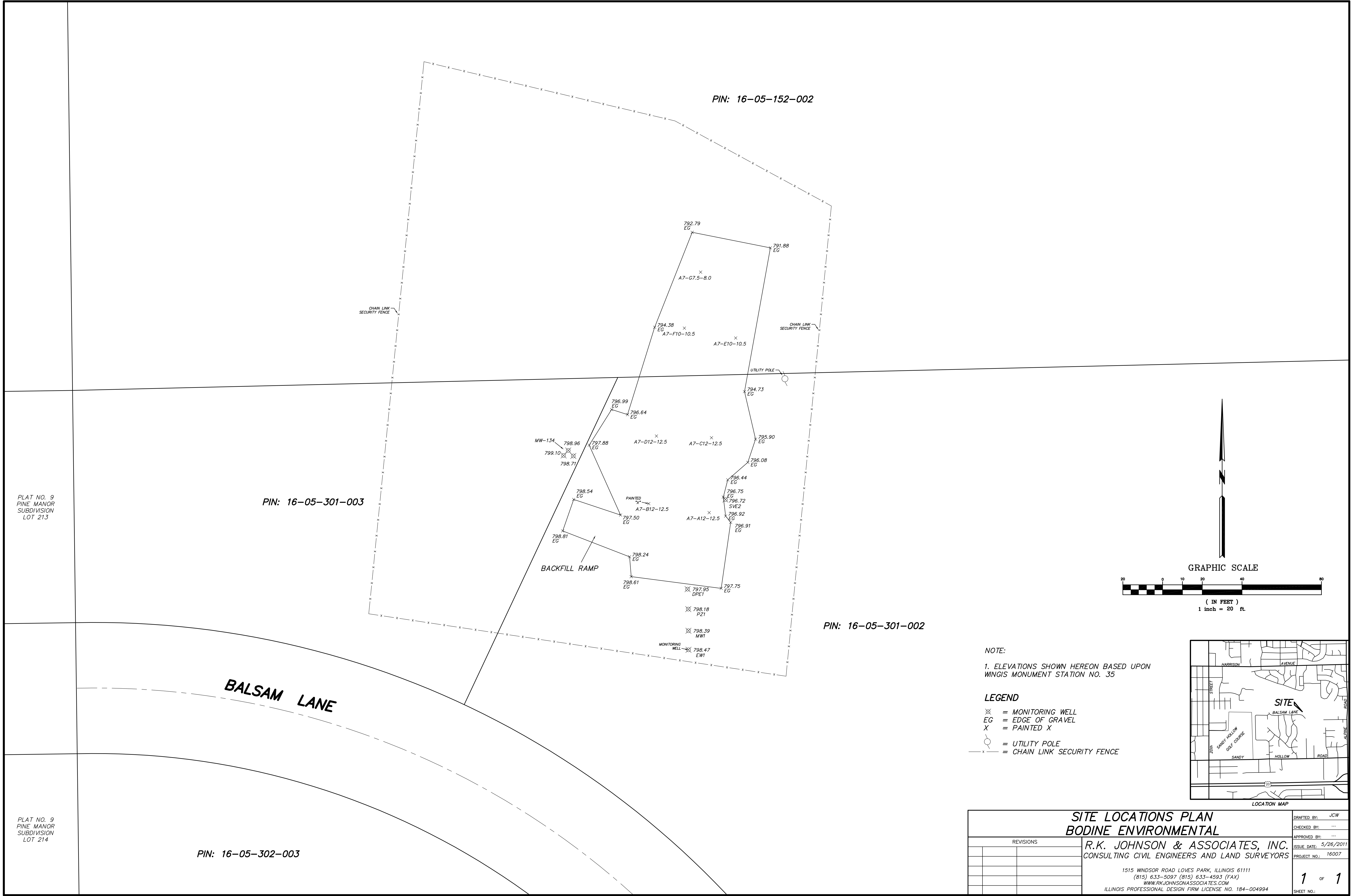
Values enclosed by "()" were not calculated according to the Illinois EPA regulations due to limited data, these values should only be used for advisory purposes such as establishing "reasonable potential".

mg/L = milligram per liter; ug/L = microgram per liter; n/a = no criterion available

Appendix A

As-built drawings

This page intentionally left blank.



PLAT NO. 9
PINE MANOR
SUBDIVISION
LOT 213

PLAT NO. 9
PINE MANOR
SUBDIVISION
LOT 214

NOTE:

1. ELEVATIONS SHOWN HEREON BASED UPON WINGIS MONUMENT STATION NO. 35

LEGEND

⊗ = MONITORING WELL
EG = EDGE OF GRAVEL
X = PAINTED X
○ = UTILITY POLE
-x- = CHAIN LINK SECURITY FENCE

**SITE LOCATIONS PLAN
BODINE ENVIRONMENTAL**

R.K. JOHNSON & ASSOCIATES, INC.
CONSULTING CIVIL ENGINEERS AND LAND SURVEYORS

1515 WINDSOR ROAD LOVES PARK, ILLINOIS 61111
(815) 633-5097 (815) 633-4593 (FAX)
WWW.RKJOHNSONASSOCIATES.COM
ILLINOIS PROFESSIONAL DESIGN FIRM LICENSE NO. 184-004994

DRAFTED BY: JCW
CHECKED BY: ...
APPROVED BY: ...
ISSUE DATE: 5/26/2011
PROJECT NO.: 16007
1 OF **1**
SHEET NO.:

Appendix B

Low-Flow Groundwater Sampling Standard Operating Procedure

This page intentionally left blank.

Low- Stress (Low-Flow) Groundwater Sampling

SOP 1-12

Revision: 3

Date: August 2020

Approved: Ernest Ashley

Technical Review: Nicholas Castonguay, P.G.

1.0 Objective

The purpose of this technical standard operating procedure (SOP) is to define the procedural requirements for low-flow (minimal drawdown) groundwater sampling.

2.0 Background

Note: Definitions are often promulgated or codified in state or local statutes, regulations, or ordinances and can vary between regulatory agencies. Definitions should be verified against the definitions provided by agencies regulating the work when applicable.

Low-flow groundwater sampling is a method of collecting samples from a well that, unlike traditional purging methods, does not require the removal of large volumes of water from the well. The objective of low-flow groundwater sampling is to collect samples with minimal alterations to water chemistry through pumping the well at a rate low enough to minimize drawdown and to avoid disturbance in the well. Low-flow groundwater sampling refers to the velocity that water enters the pump intake, and that is imparted to the formation pore water in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface of the well, which can be affected by flow regulators or restrictions.

Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrogeological situation. The objective of low-flow groundwater sampling is to pump the well in a manner that minimizes stress (drawdown) to the system. Minimal drawdown should be stabilized so that the water to be sampled is representative of the formation surrounding the screened interval and is not from the stagnant water column above the screened interval. Minimal drawdown is achieved to the extent practical taking site sampling objectives into account. Typically flow rates on the order of 0.1 to 0.5 liter per minute (L/min) are used. However, achieving flow rates of 0.1 to 0.5 L/min can be dependent on site-specific hydrogeology. Some very coarse-grained sand formations have successfully been sampled via low-flow techniques at flow rates up to 1 L/min. The effectiveness of using low-flow purging is intimately linked with proper well screen location, well screen length, and well construction and development techniques.

Low-flow groundwater sampling can be used to collect samples for all categories of aqueous-phase contaminants and naturally occurring analytes, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and other organic compounds including metals and other inorganics, pesticides, polychlorinated biphenyls (PCBs), radionuclides, microbiological constituents, and per- and polyfluoroalkyl substances (PFAS). Low-flow groundwater sampling techniques are particularly well-suited in applications where it is desirable to sample aqueous-phase constituents that may sorb or partition to particulate matter. It is not applicable to sampling wells that contain either light or dense non-aqueous-phase liquids (LNAPLs or DNAPLs).

A variety of sampling devices are available for low-flow groundwater sampling, including peristaltic pumps, bladder pumps, electrical submersible pumps, and gas-driven pumps. Pump type should be selected based on known site conditions, including well depth, well diameter, water level, and anticipated well volume, as well as sampling objectives. Note that peristaltic pumps (suction pumps) cannot be used under conditions where the water table is greater than 25 feet below ground surface. Additionally, in most instances, peristaltic pumps may not be used for collecting VOC samples because they create a vacuum that potentially contributes bias to sampling for VOC's via low flow techniques. Bailers, too, are generally inappropriate devices for low-flow sampling. Gas-driven pumps are generally not advisable for VOC or SVOC sample collection due to the potential for sample contamination.

Dedicated pumps (those that are permanently installed in the well, e.g., bladder pumps) are preferred over portable pumps because they eliminate disturbance to the water column in the well during pump insertion, thus providing lower turbidity values, shorter purge times, and lower purge volumes to achieve stabilized indicator parameter measurements. However, portable pumps can be used if care is taken to minimize disturbance to the water column during pump insertion, and if adequate time is allowed following pump insertion and prior to pump operation for any particulates agitated in the water column to settle. Both dedicated and portable pumps should be easily adjustable and should operate reliably at lower flow rates. All pumps typically have some limitations that should be evaluated with respect to site-specific considerations and data quality objectives on a case-by-case basis.

Low- Stress (Low-Flow) Groundwater Sampling

SOP 1-12

Revision: 3

Date: August 2020

Water quality indicator field parameters should be continuously monitored during low-flow purging using a flow-through cell, or in-line parameter monitoring techniques. Continuous indicator parameter monitoring is a critical component to low-flow groundwater sampling. Water quality indicator parameters include temperature, pH, oxidation-reduction potential (ORP), specific conductivity, dissolved oxygen (DO), and turbidity. The flow-through cell enables continuous collection of real-time parameters during low-flow purging. Stabilization is achieved after all parameters fall within established limits for three successive readings as discussed in Section 5. Stabilization of low-flow parameters is further discussed in Section 5.0 (Procedure) of this SOP.

Advantages of low-flow groundwater sampling are:

- Improved sample quality (e.g., less turbid and more representative of the aquifer)
- Potentially reduced purging and sampling times
- Reduced purge water volume

2.1 Associated Procedures

- SOP 1-6, *Water Level Measurement*
- SOP 2-2, *Guide to Handling of Investigation Derived Waste*
- SOP 4-5, *Field Equipment Decontamination at Nonradioactive Sites*

3.0 General Responsibilities

Project Manager - The project manager is responsible for ensuring that field personnel are trained in the use of this procedure and for verifying that well development and purging are carried out in accordance with this procedure.

Field Team Leader - The field team leader is responsible for complying with this procedure as well as reading/reviewing field plans and coordinating assigned tasks before conducting the field work.

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site-/project-specific quality assurance plan.

4.0 Required Equipment

- Site plans and well construction information
- Field logbook and health & safety plan
- Waterproof ink pens
- Pump (including peristaltic pumps, bladder pumps, electrical submersible pumps, and gas-driven pumps as discussed in Section 2.0 of this SOP).
- Appropriate controller for selected pump type.
- For bladder pumps: Compressor and controller for the system (compressed non-reactive gas may also be used in lieu of a compressor).
- Power source (e.g., battery or generator), as required.
- Pump tubing (typically polyethylene with Teflon® lining). Note that portable bladder pumps require combination tubing (for air and water); therefore, the correct tubing sizes for the portable bladder pump should be verified. Additionally, peristaltic pumps require flexible tubing (silicone or Tygon) tubing for the pump head. Polyethylene tubing with Teflon® should not be used when sampling for per- and polyfluoroalkyl substances (PFAS). It is recommended that high-density polyethylene tubing be used instead.
- Electronic water level meter or oil-water interface probe (according to SOP 1-6)
- Water quality meter (e.g., YSI 600 or YSI Professional Series) with a closed flow-through cell for continuous in-line measurement of temperature, pH, conductivity, ORP, and DO prior to sample collection.
- Turbidity meter (reporting in nephelometric turbidity units [NTUs])
- Standards for calibration and field check, as needed, of water quality and turbidity meters (as determined by anticipated field conditions).
- Volume measuring device to determine flow (e.g., graduated cylinder).

Low- Stress (Low-Flow) Groundwater Sampling

SOP 1-12

Revision: 3

Date: August 2020

- Stop watch
- Tape measure
- Engineering ruler
- Personal protective equipment as specified in the site-specific health and safety plan.
- Polyethylene sheeting
- Sample containers, including packaging supplies and all associated paperwork (e.g., chain of custody forms) as required in the sampling plan and per SOP 2-1, packaging and shipping environmental samples.
- Decontamination supplies, as required, according to SOP 4-5.
- Disposal drums (e.g., 55-gallon Department of Transportation-approved) or other purge water storage container, if required by the site-specific sampling plan.
- Photoionization detector (PID)/organic vapor monitor (OVM) or equivalent as specified in site-specific health and safety plan.

Note: All sampling devices (bladders, pumps, and tubing) should be constructed of stainless steel, polyethylene, Teflon®, glass, or similar non-reactive materials. Procedural modifications for low-flow groundwater sampling at PFAS sites are included in Section 6 and attached.

5.0 Procedure

The following steps should be followed for low-flow groundwater sampling activities:

1. Review site-specific health and safety plan, and site-specific project and sampling plans before initiating sampling activities.
2. Review available existing data for site to evaluate approach to sampling site wells. Prepare to sample site wells in the order of least contaminated to most contaminated. Additionally, existing site data should be reviewed to determine anticipated hydrogeologic conditions and well completion details.
3. Prior to sampling, all sampling devices and monitoring equipment shall be calibrated according to manufacturer's recommendations and the site-specific sampling plan. Calibration of pH should be performed with at least two buffers that bracket the expected pH range. DO calibrations should be corrected for local barometric pressure readings and altitude.
4. Put on personal protective clothing and equipment as specified in the site-specific health and safety plan.
5. Open the well cover and check condition of the wellhead, including the condition of the surveyed reference mark, if any. If no reference mark exists, create a reference mark on the well riser using a permanent marker or equivalent. Record the location of the reference mark in the field notes.
6. Monitor the air space at the wellhead for VOCs using a PID/OVM or equivalent immediately upon removal of the well plug and as according to health and safety requirements.
7. Determine the depth to static water level in accordance with SOP 1-6, taking precautions to minimize disturbance of the stagnant water column above the screened interval during water level measurement. Well depth should be obtained from review of the well completion logs, from previous work or after sampling is complete. Insertion of a water level measuring device to the bottom of the well casing will result in resuspension of settled solids from the formation surrounding the screened interval, thus requiring longer purging times for turbidity and other field parameter equilibration.
8. Dedicated sampling devices (those permanently installed in the well) capable of pumping and sampling are preferred over any other type of device. Any portable sampling device should be slowly and carefully lowered to the middle of the screened interval or slightly above the middle to minimize excessive mixing of the stagnant water in the casing above the screen with the screened interval zone water, and to minimize resuspension of solids collected at the bottom of the well or in the surrounding formation within the screened interval.

Low- Stress (Low-Flow) Groundwater Sampling

SOP 1-12

Revision: 3

Date: August 2020

9. New polyethylene tubing shall be used for each sample when using non-dedicated sampling equipment. Prepare the pump and tubing for insertion into the well. Lower the pump intake down into the well casing. Connect the flow-through cell in-line with the pump effluent tubing.
10. Generally, the pump intake should be placed in the mid-point of the screened interval. This provides consistency between sampling rounds. However, if the geology of the screened interval consists of heterogeneous materials with layers of contrasting hydraulic conductivity, the pump intake should be positioned adjacent to the zone of highest hydraulic conductivity (as determined via review of the existing site hydrogeologic conditions/well completion logs). Also, the sampling plan should be consulted to determine if particular zones (e.g., known zones of contamination) are targeted for sampling per DQOs). When conducting low flow sampling to evaluate vapor intrusion, the pump intake should be collected at or near the water table (i.e., 0-2 feet below the water table) to ensure groundwater samples are representative of the shallowest portion of the aquifer.
11. To achieve low-flow purging conditions, the purge rate should generally not exceed 0.5 L/min. Adjust the pump control to stabilize the flow rate, and therefore minimize drawdown (less than 0.3 foot during purging activities). The water level in the well should be measured throughout the purging process to monitor drawdown. Flow rate can be measured from the discharge tube using a volumetric measuring device (e.g., a graduated cylinder) and a stopwatch. (Note: determine flow rate by measuring volume in 0.5-minute or 1-minute increments.)
12. Record water level measurements, and field parameters including pH, temperature, specific conductivity, oxidation reduction potential (ORP), DO, turbidity, and flow rate every three to five minutes during the purging process. Record all measurements and observations in the logbook or on a groundwater purging and sampling form (**Attachment 1**). Purging shall continue until the field parameters have stabilized. Parameters are considered stable when three consecutive readings are within the limits of the criteria defined in Table 5.1 and/or in accordance with the site-specific sampling plan. Turbidity ideally should stabilize below 10 NTU prior to sample collection, particularly if groundwater samples are to be collected for metals or PCB analyses.

TABLE 5.1 Stabilization of Water Quality Indicator Parameters

Parameter	Units	Stabilization Criteria
Water Level	Feet/meters	< 0.3 foot (< 0.1 meter)
Temperature	°F/°C	± 3 percent, or ±1.8 degrees Fahrenheit (°F) /±1 degree Celsius (°C)
pH	(n/a)	± 10 percent, or ±0.1 standards units (SU)
Specific Conductivity	µm/cm	±3 percent (microsiemens per centimeter, or µm/cm)
ORP	mV	±10 millivolts (mV)
Dissolved Oxygen	mg/L	±10 percent for values greater than 0.5 mg/L, or 0.2 milligram per liter (mg/L) - whichever is greater. If three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized.
Turbidity	NTU	± 1 Nephelometric Turbidity Unit (NTU) (±10 percent for turbidity if greater than 5 NTU) If three Turbidity values are less than 5 NTU, consider the values as stabilized
Flow Rate	L/min	0.1 to 0.5 Liters per minute (L/min) (< 1 L/min), specific flow rates and sampling rates to be identified in the sampling plan if project/contract required.

13. In low recharge aquifers, the following steps shall be followed:
 - (1) If the initial water level is less than 10 feet above the top of the well screen, then purge the well until dry and allow sufficient recharge to collect samples.
 - (2) If the initial water level in the well is greater than 10 feet above the top of the screen, then care shall be taken to prevent the dewatering of the screened interval during purging of the well.
 - (2a) Continue purging until the water level is between 1 foot (0.3 meter) and 5 feet (1.5 meters) above the top of the screened interval.
 - (2b) Allow the well to recharge, then continue purging until at least one full initial well volume has been purged.
 - (3) Record all data, measurements, and observations in the logbook.

Low- Stress (Low-Flow) Groundwater Sampling

SOP 1-12

Revision: 3

Date: August 2020

14. After field parameters have stabilized, disconnect the flow through cell, and collect groundwater samples directly from the discharge tubing into an appropriate sample container. If using a peristaltic pump to collect VOC samples, refer to item 16 of this SOP for the correct procedure for sampling VOCs with a peristaltic pump. If an in-line, flow-through cell is used to continuously monitor indicator parameters, it should be disconnected or bypassed during sample collection. During sample collection, maintain the pump rate at the same rate used during purging (unless specified in the sampling plan). The pump rate used during sample collection may need to be lowered to minimize aeration, bubble formation, or turbulent flow of water into sample bottles, or to prevent sample preservatives from being washed out of the sample container. Note: Avoid the use of constriction devices on the tubing to decrease the flow rate because the constrictor will cause a pressure difference in the water column. This will cause the groundwater to degas and result in a loss of VOC and dissolved gases in the groundwater samples.
15. Groundwater sampling (including the collection of all required quality assurance/quality control samples specified in the sampling plan) shall be performed immediately upon completion of purging (unless time for recharge is required for low-recharge wells) using the same equipment used for purging. Sampling should occur in a progression from the least to the most contaminated well, if this is known. Generally, volatile (e.g., solvents and fuel constituents) and gas sensitive (e.g., Fe^{2+} , CH_4 , $\text{H}_2\text{S}/\text{HS}^-$, and alkalinity) analytes should be sampled first. The sequence in which samples for most inorganic parameters are collected is immaterial unless filtered (dissolved) samples are required. Filtered samples should be collected last and in-line filters should be used. After all unfiltered samples have been collected, a 0.45 micron (μm) in-line filter shall be inserted in the discharge line for collection of filtered samples, as required.
16. VOC samples should not be collected directly from the discharge end of a peristaltic pump. After field parameters have stabilized, and all other samples have been collected as required, stop the pump and simultaneously pinch the discharge end of the tubing shut. Disconnect the flow-through cell. Remove the tubing from the well and fill the VOC sample containers from the influent end of the sample tubing, (the end of the tubing that was located down-well during purging activities). The flow rate when filling sample vials may be controlled by setting the peristaltic pump in reverse.
17. Place all samples in a cooler with ice or ice packs to comply with project, laboratory, and/or regulatory requirements. Do not use "blue ice" packs with samples to be analyzed for PFAS.
18. After sampling activities have been completed, remove the portable pump assembly from the well, if used, and decontaminate all non-disposable components. Re-install and secure the well gripper plug and cover. Clean up the work area; containerize and/or dispose of purge water as required by the site-specific sampling plan, and dispose of tubing and all other disposable sampling equipment as investigation derived waste (IDW) after each use as described in the site-specific sampling plan.

5.1 Conducting Low Flow Groundwater Sampling at Per- and Polyfluoroalkyl Substances (PFAS) Sites

The evolving regulatory standards for PFAS should be considered in the implementation of low-flow groundwater sampling as well as the development of project planning documents such as: work plans, sampling and analysis plans, quality assurance project plans, data management plans, accident prevention plans, health and safety plans, and laboratory statements of work used to guide the collection of samples for PFAS analysis.

A consideration of the PFAS-specific sampling requirements is needed during the planning phase because cross-contamination is a prominent concern for data quality, particularly with PFAS action levels in the low parts per trillion (ppt) range. This means that the development of project data quality objectives (DQOs), and selection of action levels, reporting limits are all impacted with the inclusion of sampling for PFAS analysis.

Before implementing low-flow groundwater sampling for collection of samples for PFAS analysis, it is important to review current regulatory standards to determine whether site- or project-specific changes to low-flow groundwater sampling should be included in project planning documents to align with the latest regulatory standards and sampling guidance. CDM Smith regulatory updates can be located at the INFOCENTER. Specific state and federal regulatory limit updates can be found here:

https://cdmsmith.libguides.com/PFAS_InfoCenter

Low- Stress (Low-Flow) Groundwater Sampling

SOP 1-12

Revision: 3

Date: August 2020

Procedural modifications for low-flow groundwater sampling and other related field activities at PFAS sites are provide below. A check list containing common materials and sampling equipment that may contain PFAS compounds is attached and also can be found here:

<https://www.yammer.com/cdmsmith.com/#/files/214861635584>

Procedural Considerations For PFAS Sampling

Development of PFAS awareness in guidance and incorporation into specific TSOPs is necessary because cross-contamination is a prominent concern for data quality, particularly with PFAS action levels in the low parts per trillion (ppt) range. (For example, Federal drinking water MCL for Arsenic is 10,000 ppt where the EPA health advisory level is a combined 70 ppt for PFOA and PFOS.)

Procedural modifications to field activities when sampling for PFAS analysis involve the concerns listed below. Good housekeeping, detailed documentation of these extra steps and vigilance about clearly defined exclusion zones should be strictly adhered to.

Good practices

- Utilize good safety planning and institute exclusion zones, contamination reduction zones, and support zones (no visitors within 30 feet of sampling).
- Do not eat in or near sampling areas (food packaging may contain PFAS).
- Be vigilant about PPE donning and doffing practices.
- Wash hands before and after eating.
- Wear powderless nitrile gloves and change them frequently.
- Only open sample container during sample collection and never set the sample container lid down.
- Keep hands away from the container opening when sampling and keep lid protected.
- Develop a project-specific checklist for review with field personnel.
 - It should be project-specific
 - Completed prior to beginning PFAS sampling event, whenever there are staffing changes, and whenever sample media change and associated sampling/field equipment changes
 - Consider appropriate sampling/field work sequences for each matrix
 - Sampling/field work sequences
 - PFAS sampling/field work should occur first on sites where other contaminants will also be sampled.
 - CDM Smith PFAS Sampling Guidance Team can assist with development of your project-specific checklist.

Avoid

- **PTFE, LDPE**, sticky notes, waterproof field book, aluminum foil
- Field filtering of water samples because of glass fiber filters
 - Avoid use of markers, if possible, during sampling use only regular ink pens. If needed, write over regular ink with marker after the sample containers are sealed.
- Consult materials checklists for equipment concerns.

6.0 Restrictions/Limitations

Only grounded electrical devices should be used for low-flow sampling activities. If a gasoline-powered electrical source is used, place portable power sources (e.g., generators) 50 feet (15 meters) or farther from the wellhead to prevent potential contamination of samples. Additionally, it should be clearly noted in the field notes or on the Groundwater Sampling Log (Attachment 1) if a well has been pumped dry and allowed to recharge prior to sample collection, as low-flow sampling data is no longer applicable.

7.0 References

ASTM D6452-99(2012)e1, Standard Guide for Purging Methods for Wells Used for Groundwater Quality Investigations, ASTM International, West Conshohocken, PA, 2012.

Low- Stress (Low-Flow) Groundwater Sampling

SOP 1-12

Revision: 3

Date: August 2020

ASTM D4448-01(2013), Standard Guide for Sampling Ground-Water Monitoring Wells, ASTM International, West Conshohocken, PA, 2013.

Puls, R.W. and M.J. Barcelona. April 1996. Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures. U.S. EPA, Ground Water Issue, Publication Number EPA/540/S-95/504.

Reinhart, R. and Smaldone, John. September 2017. Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. U.S. EPA, Region 1 Quality Assurance Unit, EQASOP-GW4.

U. S. Environmental Protection Agency. May 2002. *Groundwater Sampling Guidelines for Superfund and RCRA Project Managers*. Ground Water Forum Issue Paper, EPA 542-S-02-001, OSWER, Technology Innovative Office, Washington, D.C.

_____. Region 4. April 2017. The Field Branches Quality System and Technical Procedures, Operating Procedure Groundwater Sampling. SESDPROC-301-R4.

Attachment 1

Site Name: _____ Date: _____ OVM: FID ☐ PID ☐ In Casing (ppm): (Initial) _____ (Vented to) _____
 Well ID: _____ Purging/Sampling Device: _____
 Initial Static Water Level (feet btoc): _____ Analytical Parameters: _____
 Final Water Level (feet btoc): _____ QC Samples Collected: _____
 Purge Start Time: _____ Sample Number: _____
 Sample Time: _____ Samplers' Signatures: _____

[illegible]

Parameter	Units	Stabilization Criterion
Water Level	Feet/meters	< 0.3 foot (< 0.1 meter)
Temperature	°F/°C	± 3 percent, or ±1.8 degrees Fahrenheit (°F) /±1 degree Celsius (°C)
pH	(n/a)	± 10 percent, or ±0.1 standards units (SU)
Specific Conductivity	µm/cm	±3 percent (microsiemens per centimeter, or µm/cm)
ORP	mV	±10 millivolts (mV)
Dissolved Oxygen	mg/L	±10 percent, or 0.2 milligram per liter (mg/L) - whichever is greater If three DO values values are less than 0.5 mg/L, consider the values as stabilized.
Turbidity	NTU	± 1 Nephelometric Turbidity Unit (NTU) (±10 percent for turbidity if greater than 5 NTU), If three turbidity values are less than 5 NTU, consider the values as stabilized.
Flow Rate	L/min	0.1 to 0.5 Liters per minute (L/min) (< 1 L/min)

Attachment

PFAS Sampling Materials Checklist

Development of PFAS sampling guidance TSOPs is necessary because cross-contamination is a prominent concern for data quality, particularly with PFAS action levels in the parts per trillion (ppt) range. The levels of awareness for PFAS cross contamination vary by the opportunities of introducing PFAS into the environment media under investigation.

1. Critical: Items in direct contact of environmental media under investigation. These can include, but not limited to, sample containers, sampling parts and equipment, drilling equipment, well construction items and materials, parts and equipment for hydrogeological testing, in-situ treatment parts and equipment.
2. Very Important: PPE, personal hygiene that are used by sampling personnel.
3. Important: Items used in coolers for shipping and transporting PFAS samples.
4. Less important/awareness level concern: Activities in the staging area away from immediate PFAS investigation area.

Item	Good to Use	Need Verification (2)(3)	Should Avoid (1)(2)	Comments
Field Clothing or PPE				
Clothing or boots containing "water resistance" or "stain-treated" fabrics			X	
Cloths washed with fabric softeners			X	Fabric softeners may contain PFAS.
New and unwashed clothing			X	fabric treatment may contain PFAS
Uncoated Tyvek		X		USEPA PFAS sampling guidance from Region 2 prohibits use of Tyvek.
Coated Tyvek			X	
PVC or wax-coated fabrics	X			
Neoprene	X			
Synthetic and natural fibers (preferably cotton)	X			
Steel-toed boots made with polyurethane and PVC	X			If it is not possible to find PFAS free steel-toed footwear, PFAS-free over boots may be worn. The over boots must be put on and the hands washed after putting the over boots on prior to the beginning of the sampling activities. Over boots may only be removed in the staging area and after the sampling activities have been completed.
Well-laundered clothes	X			several times from time of purchase.
Well-washed cotton coveralls	X			washed several times.

SOP 1-12 | Low Stress (Low Flow) Groundwater Sampling

Item	Good to Use	Need Verification (2)(3)	Should Avoid (1)(2)	Comments
Personnel Hygiene and Protective Skin Products				
Sunscreens		X		Good to use: Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, and baby sunscreens that are “free” or “natural.”
Insect Repellents		X		Good to use: Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellent, Herbal Armor, California Baby Natural Bug Spray, BabyGanics.
International brands of sunscreens and insect repellents		X		Must be evaluated on a case-by-case basis.
Field Sampling Items				
Waterproof field paper or books			X	Use loose plain paper.
Post-it notes			X	
Aluminum foil			X	
Brand-name markers			X	Sharpie may be used to label sample bottles in the staging area, but markers should not be used in the immediate sampling environment.
Off-brand markers		X		
Ball point pens	X			
plastic clipboards			X	NJ DEP sampling guidance, use metal clipboard.
Plastic table cover			X	
Sampling Equipment				
Item containing high-density polyethylene (HDPE)	X			
Item containing polypropylene	X			PP sample bottles must be used for drinking-water samples in accordance with USEPA method 537.1.1.
Item containing polyurethane	X			
Item containing Polyvinyl chloride (PVC)	X			
Item containing silicon	X			
Item made of stainless steel	X			
Alconox®	X			
Citronex®	X			
Liquinox®	X			
Powderless nitrile gloves	X			

SOP 1-12 | Low Stress (Low Flow) Groundwater Sampling

Item	Good to Use	Need Verification (2)(3)	Should Avoid (1)(2)	Comments
HDPE Hydrasleeves or sonic core bags	X			
Neoprene	X			
Crisco® or other vegetable-based greases for lubricating parts	X			
Item containing PTFE			X	Items or equipment that contains PTFE parts that will be in direct contact with sampling media.
Item containing Teflon®			X	Field sampling items or equipment that contains Teflon® and that will be in direct contact with the sampling media.
Item containing fluoropolymer			X	
Low-density polyethylene (LDPE)			X	Items or equipment that contains LDPE parts and that will be in direct contact with the sampling media.
Viton® O-rings			X	Viton® O-rings used in pressure washers used for sampling equipment decontamination.
Glass sample containers			X	
Field filter			X	Field filtration should be avoided regardless of filter types.
Decon 90			X	
Items containing fluorosurfactants			X	
Teflon-bearing plumber's tape			X	
Blue (or chemical) ice			X	Later data (unpublished) suggest no cross contamination from blue ice. The category may be changed after data are published.
Water ice	X			Double bag in polyethylene bags.
Internal valves and equipment parts for sampling or decon		X		
Methanol or other solvents		X		
LDPE plastic bags (e.g., Ziploc® bags)		X		For larger biota sampling, Ziploc bags may be used, but collecting an equipment blank is recommended because these bags may be made of LDPE.
Drilling fluids		X		
LDPE sonic core sample bags		X		Manufactured by Boart Longyear and Hole Products.

SOP 1-12 | Low Stress (Low Flow) Groundwater Sampling

Item	Good to Use	Need Verification (2)(3)	Should Avoid (1)(2)	Comments
Equipment with moving parts that may be lubricated with PFAS containing lubricants or greases		X		
Rental equipment		X		Must be verified to have no PFAS-bearing parts prior to use.
Others				
Food wrappers			X	Field personnel must wash hands after having food wrapped with grease repelling paper.

- (1) If an item that may contain PFAS but alternative is not available, the item should be tested for PFAS before use.
- (2) This mostly refers to the immediate sampling environment, particularly, the item is in contact with environmental media to be sampled.
- (3) There are no standard operation procedures on how an item can be verified. Please contact PFAS experts for advice on the best practice for testing an item for potential PFAS contamination.